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The SKYLAB Concentrated Atmospheric
Radiation Project

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Final Report

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September 1, 1975

To

L. B. Johnson Space Center
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THE SKYLAB CONCENTRATED ATMOSPHERIC RADIATION PROJECT
CONTRACT T-4714B

P. M. Kuhn, W. E. Marlatt, and V. S. Whitehead

In conjunction with SKYLAB measurements, data were obtained at Earth's surface, in the boundary layer, and from aircraft, to be used to improve understanding of radiation transfer within the atmosphere. Measurements included total net radiation, albedo and temperature of the interface, atmospheric profiling of atmospheric radiative flux and layer cooling, and aerosol density, size, and distribution; total extinction coefficients were calculated. Instrumentation for observations is described. Data from radiometer-sonde observations, and the computer listings of the data are included in Appendices. Models for computing atmospheric IR transmission are compared. Spectral estimates of planet albedo are given and compared with SKYLAB observations. Performance of models is evaluated, and recommendations are made regarding the need for further studies.

1. INTRODUCTION

Participants in the SKYLAB Concentrated Atmospheric Radiation Project (SCARP) utilizing the Earth Resources Experiment Package flown on SKYLAB were Dr. P. M. Kuhn of the NOAA, Environmental Research Laboratories, Dr. W. E. Marlatt of the Department of Earth Resources, Colorado State University, and Dr. V. S. Whitehead of NASA, Earth Observations Division of Johnson Space Center. These were joined in the Phoenix field measurements by R. F. Pueschel of the NOAA Environmental Research Laboratories and L. Edwin Williamson of the White Sands Missile Range, New Mexico.

1.1 Approach

The ultimate purpose of the project was to arrive at a more complete understanding of radiation transfer within the atmosphere, including the contribution of aerosols to this transfer. Intermediate goals were as follows:

1. To acquire data giving a comprehensive description of the atmosphere's structure and composition over sites of differing radiation properties for a variety of air masses. Our measurements were taken at the surface and at levels between the surface and the spacecraft to support the SKYLAB infrared spectrometer, and scanner measurements of selected sites.
2. To acquire and implement several models of radiation transfer for both visible and thermal regions; and to test these models against observations.

3. To apply the result of these tests to improve models for the variety of existing air masses and atmospheres.

Data were acquired in two related experiments, in which a variety of measurements were taken (1) at the Earth's surface and in the boundary layer, and (2) from aircraft. A number of existing radiative transfer models allowed for varying air masses and amounts of wet and dry aerosols.

It was anticipated that other investigations could make use of the data base acquired. Hence the experiment was declared an open one and other investigators participated on an exchange-of-data basis. Among them were Ed Williamson of White Sands Missile Range and Rudolf Pueschel of NOAA's Atmospheric Physics and Chemistry Laboratory. Data exchanges occurred with EPA which provided a lidar in the first field effort, with the Texas Air Control Board for data acquired in the Houston area, and with other SKYLAB investigators.

To acquire the desired variety in the data base, sites were selected and data acquired onshore and offshore in the vicinity of Houston, Texas, to provide a warm moist clean and a warm moist dirty atmosphere; over White Sands Missile Range, N. M., (both sands and the mal pais) to provide extremes of surface characteristics for a clean dry atmosphere; and over Phoenix, Arizona, to provide hot dry clean and hot dry dirty atmosphere. Other sites surveyed (San Francisco, Four-Corners, and St. Louis) were not used because of operational constraints, primarily those of weather.

1.2 Acquisition of Data

Each field effort differed somewhat from the other in the type of data acquired as the investigators attempted to apply the experience of the preceding effort. Description of a typical exercise follows.

1. Personnel and equipment were moved to facilities nearest to the points of the field effort about three days prior to the scheduled SKYLAB overflight. Last minute changes to the operation plans were made.
2. Two days prior to the SKYLAB overflight a low key field effort was initiated primarily to check out equipment and procedures. During this day one or more radiometersonde releases would be made by P. M. Kuhn and Associates. Surface meteorological and radiometric measurements would be made at more than one site. The Colorado State aircraft would fly at least one multiple level pattern between sites with sensor operating for general familiarity, timing, and instrument test. This days' effort would be concluded by a general debriefing on problems and re-planning where desirable.
3. On the day prior to the SKYLAB overpass, a schedule was followed identical to that planned for the day of the overpass. The schedule included hourly, or continuous measurement of the following:

- (1) Downwelling and upwelling solar flux.
- (2) Direct beam solar radiation and albedo.
- (3) Total net radiation at the surface.
- (4) Radiation temperature of the surface, sky, and cloud.
- (5) Wind, temperature, and dew point.
- (6) Sky cover (photographs).
- (7) Radiometersonde profiles (temperature, dew point, up- and downwelling thermal radiation, and layer cooling) each three hours.
- (8) Interface temperature measurements from ground and helicopter.
- (9) Aircraft profiles from near surface to above the haze layer (profiles of aerosol number density and size distribution, upwelling and downwelling solar flux, and profiles of temperature and dew point). Three times daily: early morning, at time of day of SKYLAB overpass and late afternoon. If the time of day of SKYLAB overpass differed greatly from the time of maximum surface heating another flight would be attempted at that time.

4. On the day of the overpass, the same schedule was followed, with the addition of the SKYLAB crew's participation. Because the SKYLAB data had to be acquired within 30 seconds, the crew had been provided photographs of measurement sites, to aid in recognition and fast response when the spacecraft passed over the site. SKYLAB data were obtained for us with an S190A multispectral camera, an S190B mapping camera, an S191 spectrometer, and an S192 multispectral scanner. The camera and scanner system were pointed at nadir in the Z-local vertical mode. The spectrometer, however, could be directed to point at a specific site by the operator to acquire several spectral scans. It should be noted that late in the planning stages for SCARP, the opportunity to use a helicopter mounted S191 spectrometer was accepted and profiles from near-surface to 12,000 feet were acquired for the same sites as those observed by SKYLAB.
5. It was initially planned to maintain the same observation schedule the day following the SKYLAB overpass as on the two days preceding in order to take advantage of the established field deployment to acquire data from more varied air masses. This was discontinued about midway through the field program for efficiency in scheduling. Exercises were then terminated about 24 hours after the SKYLAB overpass with only a single, or at most, two flights by the Colorado State University aircraft and one or two radiometersonde releases on that day. The exercise was concluded with a review of the effort and suggestions for planning of the next field exercise.

2. SURFACE AND BOUNDARY LAYER EXPERIMENT (NOAA)

P. M. Kuhn and L. P. Stearns

2.1 Instrumentation

2.1.1 Precision Radiometer

The Barnes PRT-5 radiometer was used for measurements of the interface temperature at the various SKYLAB sites. It consists of an optical unit and an electronic unit with interconnecting cables. The optical unit compares the amount of energy emitted by the interface with that emitted by an internal, controlled reference. The electronics unit converts the comparison into a voltage that can be recorded or read on a front panel meter. The detector is a hyper-immersed thermistor bolometer in a reference temperature cavity. Lenses restrict the spectral interval measurements from 8-14 microns. The instrument accuracy is 0.5C and the response time varies with the setting of an adjustable bandwidth setting from 5 to 500 milliseconds. The field of view is approximately 2°.

- Effective radiance (N_{eff}) is defined as

$$N_{\text{eff}} = \int_0^{\infty} \frac{R_x}{R_{\text{pk}}} N_{\text{BB}} d\lambda, \quad (1)$$

when $\frac{R_x}{R_{\text{pk}}}$ is the normalized spectral response of the instrument and N_{BB} is the black body radiance.

2.1.2 The Radiometersonde

The radiometersonde used for soundings of the atmospheric temperature, pressure, relative humidity, and hemispheric radiation flux profiles, looking upward and downward at the various SKYLAB sites, was a combination of the Suomi-Kuhn Economical Net Radiometer attached "piggy back" to a standard balloon-borne radiosonde. The radiometer is a double-faced hemispheric bolometer with broad-response blackened sensing surfaces at night, white in the sunlight, shielded by two thin polyethylene membranes. The sensors used were rod thermistors with precalibrated constants. Flux evaluations are made for 0.5-micron spectral intervals to compensate for the irregularity of the blackened surfaces. The unit is attached to a radiosonde in a horizontal manner with a sequencing device enabling the data from the radiometer to be recorded in sequence with that of the radiosonde. These data from the balloon-carried radiometersonde are transmitted by a 403-MHz transmitter to a ground receiving location and recorded on a strip chart. At the White Sands and Phoenix sites, the transmitter was a 1680 MHz unit.

The frequencies representing temperatures were recorded and changed to temperatures based on the expression

$$f = \frac{F_{ref} \times R_{ref}}{R_{therm} + R_{ref}} \quad (2)$$

where R_{ref} is the resistance of the modulator equal to 44.9 kilohms and F_{ref} is the frequency of the modulator at this resistance equal to 190 cps or 95.0 frequencies on the strip chart record.

The flux at any pressure level, looking upward or downward, may be obtained by the equations

$$F_{\downarrow} = \sigma T_t^4 + A[-k_i(T_b - T_t)/D - k_t(T_a - T_t)/d] + \lambda d T_t/dt,$$

$$F_{\uparrow} = \sigma T_b^4 + A[+k_i(T_b - T_t)/D - k_b(T_a - T_b)/d] + \lambda d T_b/dt,$$

and $F_{net} = F_{\uparrow} - F_{\downarrow}.$

Since A , B , k_i , k_t , k_b , σ , λ , D , and d are all defined constants, it remains only to measure the parameters T_a , T_t (top plate temperature), and T_b (bottom plate temperature) to determine the radiant fluxes with the predetermined log term based on the time, t . Once the net radiative flux is calculated, an additional term may be computed, that of the uncompensated atmospheric layer warming/cooling (W). It may be expressed as

$$W = - \frac{g (F_i - F_{i-1})}{C_p (P_i - P_{i-1})} \times 1440, \quad (3)$$

where g is the acceleration of gravity, C_p is the specific heat at constant pressure, and 1440 is the number of minutes in a day. The error of the instrument is 7 watts per square meter.

2.1.3 The Net Radiometer

The Suomi-Franssila-Isplitzer Net Radiometer was used for measuring the net flux of radiation energy through a surface parallel to the Earth's surface at the SKYLAB sites. This instrument has a specially designed vane in the nozzle throat and an electric heater to furnish a sensitive control over the ventilation so that the cooling power in each side of the plate can be equalized. The sensing range is from 0.17 to 80 microns from a sensor consisting of a glass plate wound by 360 spaced turns of copper and constantan wire to form a thermopile after proper plating and blackening. About six percent of the entire surface of the blackened sensor is also coated with a strip of highly reflective white paint to compensate for solar radiation. The resistance of the thermopile is read directly from the calibrated sensor and is recorded in millivolts. It is capable of measuring total net radiation to within an accuracy of 2 percent.

2.1.4 The Pyronometer

The Model 2 Eppley Pyronometer was used to measure the incoming solar radiation and albedo at the SKYLAB ground sites. This is a precision pyronometer incorporating a fast-response, wirewound, plated with copper/constantan, temperature-compensated thermopile and two miniaturized hemispheres of WG 7 glass. It was calibrated against standards verified against the Eppley primary reference group (Eppley-Ångström electrical compensation pyrhemimeters) which maintains and reproduces the International Pyrhemimetric Scale in the United States.

2.2 Radiometersonde Observations

During SKYLAB Phases II, III, and IV, 28 radiometersonde ascents were made before, after, and during the overpass times of the satellite laboratory. They occurred in the oil fields near Rosenberg, Texas; at White Sands, New Mexico, at both the lava area and the sands area; in the desert near Phoenix, Arizona; and finally in St. Louis, Missouri. At the last site, no SKYLAB measurements were made, but our data are included. Table 1 is a list of the ascents with comments.

2.2.1 The Data

In Appendix A are the data plotted by a CRT unit of CDC 6600 of the ascents. Air temperature is denoted by T, upward radiant flux by Δ , downward radiative flux by ∇ , net radiation flux by O, warming/cooling by C, and humidity by M. Here langleys/min may be rewritten $\text{cal cm}^{-2}\text{min}^{-1}$. The computer plots the humidity in gm kg^{-1} , using the radiation scale.

Appendix B is the computer listing of the data in Appendix A. Column headings are provided and again ly/min is equivalent to $\text{cal cm}^{-2}\text{min}^{-1}$. The relative humidity is in percent. In flight number one, only, the radiative flux profiles are invalid and only the pressure, temperature, and moisture profiles should be considered.

2.3 Thermal Radiation Calculation Model, Program Radiance

The infrared radiation transfer program RADIANCE has been developed and modified to include ten options, all involving use of the radiative transfer equation. The program takes into account transfer through aerosols, the latest measurements of carbon dioxide, water vapor, window regions, and ozone. Therefore, radiance and irradiance may be determined for any infrared spectral interval to one inverse centimeter and at any angle either to include or to exclude aerosols or carbon dioxide. It may calculate black-body equilibrium temperatures, spectral intervals, weighting functions, brightness (apparent) temperatures, net irradiance, and profiles, or it may be inverted to infer water vapor at specified levels when only the temperature profile is known. Appendix C is a logic flow chart of the program and Appendix D is a listing of the program.

Table 1. Radiometersonde Ascents

No.	Date	Location	Time	Weather/Clouds	Comments
1	6/04/73	RNB	1300 CDT		Air temps only
3	6/05/73		0537 CDT		
5	6/05/73		1713 CDT		
6	6/06/73		0855 CDT	5Cu	
7	8/07/73	RNB	1715 UT	5Cu 2Ac 2 Ci	
8	8/07/73		2212 UT	35 ϕ Cu 7 Ci	
9	8/08/73		0146 UT	9 Ci	Nite
10	8/08/73		1438 UT	2 Cu 30, 1 Ac 120, 1 Ci	
11	8/08/73		1600 UT	4 Cu	Overpass
12	8/08/73		1937 UT	4 Cu 30, 4 Ac 120, 2 Ci	
13	8/09/73		1516 UT		
14	8/09/73	BUC TWR	0835 CDT		
15	8/11/73	W.S. LAVA	2138 UT		
16	8/11/73		0000 UT		
17	8/12/73		1432 UT		
18	8/11/73	W.S. DUNES	2130 UT		
19	8/11/73		2400 UT		
20	8/12/73		1437 UT		
21	9/06/73	PHX #5	0800 MST	0 Ac, Ci	
22	9/06/73		1015 MST	0 Ac, Ci	
23	9/06/73		1405 MST	0 Ac, Ci	
24	9/06/73		1900 MST	0 Ac, Ci	
25	9/07/73		0800 MST	Clear	
26	9/07/73		1130 MST	Clear	
27	1/18/74	ST. LOUIS	1250 CDT	5 Cc, Cs	
28	1/18/74		1535 CDT	E5, 10 Cu RW -	Thru front

2.3.1 Purposes of RADIANCE Program Sections

Radiance and irradiance. To determine the radiance and integrated irradiance values over desired wavelength intervals, angles and specified filters with input pressures, temperatures, and mixing ratios. This also provides the integral water vapor and the carbon dioxide and water vapor totals above or below the background pressure.

Black-body equilibrium temperatures. To determine the black-body radiance and normalized radiance for specified frequencies and filters over an input temperature range at specified intervals.

Spectral intervals. To list the radiance of each frequency of a band at ten inverse centimeter intervals.

Infrared weighting. To determine the quotient of the differential of the transmissivity for two levels divided by the differential of the natural logarithm of the pressure levels printed for each average pressure and temperature in a temperature versus pressure profile for each specified frequency and angle. Quotients are radiometric transmission weighting functions enabling one to determine "penetration" depth for a radiation observation in the atmosphere. Output includes punched cards of average pressures and quotients.

Atmospheric corrections to observed brightness temperatures. To adjust the apparent or brightness temperature of the background or interface, for specified intervals and angles. This procedure reconstructs the physical temperature of the interface.

Bignell method of determining aerosol contribution. To determine radiance and integrated irradiance using two absorption coefficients in the continuum at specific wavelengths following the method of Bignell (1970).

Aerosol. To determine radiance and integrated irradiance for specified layers in an atmospheric profile for different types and sizes of aerosols, using a bulk volume absorption coefficient.

Net integrated irradiance and layer warming/cooling. To determine the difference between the upward and downward irradiance, using the differential irradiance to determine the warming/cooling of a layer. Output includes punched cards of pressure, temperature, and layer warming/cooling.

Water vapor inference. To determine the total water vapor burden above the reference level and the mixing ratio at the reference level by inference of the radiative transfer equation. To determine the relative humidity at the reference level with respect to water.

Profiler. To determine a temperature or humidity profile from aircraft by measuring the radiance with assorted carefully chosen filters or at different angles by inverting the radiative transfer equation and using the already determined infrared weighting functions. Output includes cathode ray tube plot.

2.3.2 Method of Development of the Transfer Model

Determination of the radiance. The transfer of radiation observed or calculated at a reference level, r , in the atmosphere is given by

$$N_r = - \int_{\nu_1}^{\nu_2} \int_{\tau=1.0}^{\tau} \phi(\nu) B(\nu, T_a) d\tau d\nu + \int_{\nu_1}^{\nu_2} B(\nu, T_0) \phi(\nu) \tau d\nu, \quad (4)$$

where ν is the wavenumber,

τ is the atmospheric transmission in specified spectral intervals and, by the multiplicity theorem, is equivalent to

$$\tau_{H_2O} \cdot \tau_{CO_2} \cdot \tau_{O_3} \cdot \tau_{\text{continuum}},$$

ϕ is the response function of the radiometer including the filter and detector transmission product,

B is the Planck function,

T_a is absolute temperature of an air layer,

T_0 is the physical temperature at the surface, and

$d\tau$ is equivalent to $\tau_{i+1} - \tau_i$, where i refers to successive atmospheric levels.

With no atmosphere present Eq. (1) may be written,

$$N_0 = \int_{\nu_1}^{\nu_2} B(\nu, T_0) \phi(\nu) d\nu. \quad (5)$$

The Planck body radiation expression is given by

$$\int_{\nu_1}^{\nu_2} B(\nu, T) d\nu = \sum_{\nu} (a\nu^3 / \exp(b\nu/T) - 1) \Delta\nu \quad (6)$$

where a is equal to 3.7413×10^{-5} erg cm²sec⁻¹ and b is equal to 1.4389 cm deg.

Combining Eqs. (2) and (3) permits the additional solution of T , the equivalent black-body or brightness (apparent temperature) given by

$$T = \sum_{\nu} b\nu / \ln ((\phi(\nu)\nu^3/N_0) + 1) \Delta\nu. \quad (7)$$

Where, in the usual sense, an atmosphere is present, N_0 must be replaced by N_r from Eq. (1) and the solution proceeds to T , a brightness or apparent temperature not equal to the physical temperature T_0 given in Eq. (1). " T " is the required temperature of any interface. The brightness temperature T , is adjusted to give the true, physical temperature, T_0 , by radiometric vertical profiling of the interface temperature through various atmospheres.

Addition of aerosols to model. (a) Bignell continuum transfer model: Water vapor continuum is determined as suggested by Bignell (1970) by using the total absorption coefficient at temperature T and total pressure p (p,e) by

$$k(T,p,e) = k_1(t) p + k_2(t)e \quad (8)$$

where k_1 is the absorption coefficient at unit total pressure for foreign broadening and k_2 is the absorption coefficient at unit partial vapor pressure for e-type absorption. (b) Particulates transfer modeling: The transmissivity of aerosols may be determined by

$$-\ln \tau = K \int dz \quad (9)$$

where K is the volume absorption coefficient, and z is the height of the layer specified.

Layer warming/cooling. It has been determined by Robinson (1950) that the use of radiance measurements at 52.5 degrees off zenith in calculating the irradiance or flux closely approximates the value of integrated irradiance over 0-90 degrees. The use of this angle then makes simple and inexpensive the computation of the net flux and consequently the atmospheric temperature change for a layer. The layer warming/cooling may be given by

$$\frac{\Delta T}{\Delta t} = \left(-\frac{+g}{C_p} \right) \left(\frac{\Delta F}{\Delta p} \right) (1440) , \quad (10)$$

where F is the net irradiance ($\text{cal cm}^{-2}\text{min}^{-1}$), p is atmospheric pressure (millibars), C_p is the specific heat at constant pressure and 1440 is the number of minutes in a day.

Water vapor inference. The following equations show the technique by which water vapor may be inferred from observed radiance.

The modified equation (1) for downward radiance only is given by

$$N_{\downarrow} = \int_{\nu_1}^{\nu_2} \int_{pr}^1 \phi(\nu) B(\nu, T(p)...) \frac{\partial \tau(u(p), \nu)}{\partial p} dp d\nu \quad (11)$$

where u is the optical mass of water vapor. Here the downward radiance is measured, the filter function is known; a temperature profile above the reference is assumed by using the sounding of the nearest high altitude observing station. The altitude of the reference point (pressure) is known, and finally the frequency band of the radiometer is known, having been selected to be in the water vapor band. Consequently, the only unknown in Eq. (8) is the water vapor optical mass.

Radiance may vary by changing the optical mass since

$$\tau = \tau(w, k) \quad (12)$$

where k is the absorption coefficient for water.

An iterative method is then applied to equation (8) with a different value for u , until the difference between the observed radiance and the newly calculated radiance is minimized. This may be expressed as

$$(N_{\downarrow 0} - N_{\downarrow c}) \leq \epsilon \quad (13)$$

where ϵ is the noise equivalent radiance of the radiometer.

The optical mass varies with the reference level mixing ratio q_0 in the mathematical approximation for u . This may be expressed as

$$u = \frac{1}{g} \int_{p_r}^p \bar{q} dp \approx \frac{1}{gp_r} \sum_i q_0 p_i^\lambda \Delta p. \quad (14)$$

Here g is the acceleration of gravity; the subscript "r" refers to the reference level, and λ is a power law exponent. By carefully choosing the value of λ one may assume a constant mixing ratio or, as experimentally determined, a more realistic profile for the mixing ratio.

Profiling. The method by which the temperature or humidity profile from aircraft may be inferred utilizes the fact that the frequency of the filter or the angle of measurement (x) may be varied, thereby varying the level of the atmosphere from which the radiance measured originates. The upwelling radiance observed by the radiometer is a function of the atmospheric temperature and humidity profiles.

The radiative transfer Eq. (1) may be rewritten as

$$N_r = B(x, p_0) \tau(x, p_0) - \int_{p_r}^p (x, p) \frac{d\tau(x, p)}{dp} dp. \quad (15)$$

Here x refers to the frequency or angular characteristics of each observation, (x, p_r) is the atmospheric transmission between the aircraft pressure level (p_r) and pressure p , and p_0 is the surface pressure. $B(x, p)$ is the Planck radiance and is given by

$$B(x, p) = C_1 v^3 / [\exp(C_2 v / T(p)) - 1] \quad (16)$$

where C_1 and C_2 are Planck constants. $\frac{d\tau(x, p)}{dp}$ in (12) is called the weighting function.

Program RADIANCE uses a direct iterative method to obtain the inverse solution of (12) and (13), and the process is repeated until convergence between the observed and calculated radiance is achieved. This may be expressed as

$$[\sum (N(x, p_r)_{\text{calc}} - N(x, p_r)_{\text{obs}})^2]^{\frac{1}{2}} \leq \epsilon \quad (17)$$

where ϵ is the noise equivalent radiance of the radiometer. Rapid convergence is obtained by using a modified Newton-Raphson routine.

2.4 Infrared Radiation Observations and Calculations in the Atmosphere

2.4.1 Background

The SKYLAB field phase in June, August, and September of 1973 in the Houston, White Sands, and Phoenix areas provided a unique opportunity to conduct infrared observations and subsequent calculations of the transmission and absorption properties of haze and middle altitude clouds. The observations used both an 8.0 to 13.0 μm downward looking chopper radiometer and an upward-downward looking radiometer (4.39 to 40 μm) attached to a standard radiosonde.

One aspect of this research was to observe experimentally and analyze a volume absorption coefficient together with related optical properties of dust and middle tropospheric clouds to permit a simple solution for bulk radiation transfer phenomena. Since a detailed, moderately high resolution (1.0 cm^{-1} resolution) radiative transfer approximation program, RADIANCE, has been in use by the authors for several years, and since it being continuously updated, it is only necessary to add these additional absorbers to the existing solution once their radiative character is determined. This in-situ method of determining the haze and cloud optical properties is different from other methods and therefore can provide interesting comparisons.

For the radiometric transfer calculations, the simultaneous radiometersondes provided profiles of the free air temperature and humidity profiles. In each site the measurements were made over nearly homogeneous surfaces in order to provide a nearly uniform interface.

The upwind and downwind locations chosen from some large source such as Phoenix enabled a determination of the IR transmission of both dust and altostratus clouds. In each case, the bases and tops were distinct.

2.4.2 Some IR Radiative Properties of Haze and Clouds

Platt (1973, 1974) as well as Kuhn et al. (1974) and Kuhn (1970) have investigated and reported their results concerning some of the optical properties of cirrus, contrails, and middle altitude clouds. Preceding much of this work were the efforts of Hall (1968) in determining a physical model of radiative transfer in cirrus. The general agreement, at least insofar as the volume absorption coefficient is concerned, is very good. The investigation of middle altitude cloud radiative properties was prompted by a desire to compare these results with previously reported results of Platt (op. cit.) on middle latitude clouds.

The monochromatic emissivity of a haze layer or a cloud layer on the basis of continuity is defined as

$$\epsilon_{\lambda} = 1 - \tau_{\lambda} - \rho_{\lambda}, \quad (18)$$

where τ is the transmission and ρ the IR reflectivity. From (1) we may write, ignoring ρ ,

$$\ln \tau_{\lambda} = \ln(1 - \epsilon_{\lambda}) = (-k_{\lambda} \Delta Z), \quad (19)$$

where K (km^{-1}) is the volume absorption coefficient and ΔZ (km) is the cloud thickness or depth. We now define a bulk absorption coefficient, $K_{\Delta\lambda}$, covering a small spatial interval, $\Delta\lambda$, from 9.5 to 11.5 μm hereafter symbolized as K (Kuhn et al., 1975).

To facilitate comparisons, Table 2 lists the haze and/or cloud physical properties with the symbols employed by the authors on the left and those of Platt (1974) on the right.

Table 2. Physical Properties of Atmospheric Absorbers

This work	Platt
Optical Thickness : $\Delta u = \int_{z=0}^z K \Delta Z$	$t_A = \int_{h=0}^h dh$
Vol. Absorp. Coef.: $K(\text{km}^{-1})$	$\sigma(\text{km}^{-1})$
Cloud Thickness : $\Delta Z(\text{km})$	$h(\text{km})$
Thickness vs. ϵ : $K \Delta Z = \ln(1 - \epsilon)$	$\tau_A = \ln(1 - \epsilon)$

2.4.3 Methods of Analyses

Consider a haze or cloud layer of thickness ΔZ , and optical thickness, $K \Delta Z$, as in figure 1.

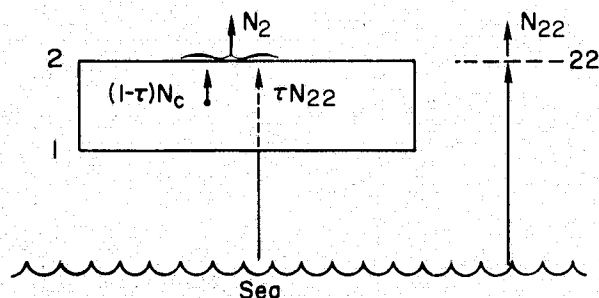


Figure 1. Symbolic atmospheric haze layers with arrows depicting upwelling IR radiance. Here τ represents $\tau_{\Delta\lambda}$ as above in (18).

The radiance transmission $(1-\epsilon)$ is given by

$$\tau = \frac{N_{2\uparrow} - N_{c\uparrow} - \rho(N_{2\uparrow} - N_{c\uparrow})}{N_{22\uparrow} - N_{c\uparrow}} \quad (20)$$

and the radiance emissivity is given by

$$\epsilon = \frac{N_{2\uparrow} - N_{22\uparrow} - \rho(N_{2\uparrow} - N_{c\uparrow})}{N_{c\uparrow} - N_{22\uparrow}}, \quad (21)$$

where τ , ϵ , ρ , and N all represent parameters over the small wavelength interval, $\Delta\lambda$. Thus we treat a "bulk" τ , ρ , ϵ and K . The errors in the determination of the absorption coefficient are based on a radiometer noise equivalent radiance of $2.35 \times 10^{-6} \text{ W cm}^{-2} \text{ sr}^{-1}$. This results in an average error of $\pm .05$ in the transmission or emissivity, τ and ϵ , respectively. The error in the volume absorption coefficient from (2) is given by

$$dK = \frac{1}{\Delta Z} \frac{d\tau}{\tau} \quad (22)$$

From Eq. (22) and from an average error of ± 0.05 in transmission, the average error in the volume absorption coefficient, K , is $\pm 0.009 \text{ km}^{-1}$. The flux or irradiance emissivity is required in place of the zenith emissivity for radiative flux transfer and IR cooling calculations. Elsasser (1960) shows that the flux emissivity, ϵ_f , is approximately equal to the zenith emissivity, ϵ (our observations), of unidirectional radiance from a column of optical depth, $K\Delta Z$, $1.66(K\Delta Z)$.

In these equations N_{\uparrow} is the upwelling radiance ($\text{W cm}^{-2} \text{ sr}^{-1}$), ρ the layer IR reflectivity, and the subscript "c" is the black body radiance at the mean temperature of the layer. Subscripts 1, 22, and 2 refer to layer levels (Fig. 1). "22" is the same level as "2" but is the upward radiance in a dust-free or cloudless atmosphere. For shallow layers $N_{1\uparrow}$ may be used in place of $N_{22\uparrow}$ in Eq. (20) with only a small error. However, in deeper layers ($>1.5 \text{ km}$) $N_{22\uparrow}$ must be employed. This necessitated a profile in a haze or dust-free area or outside of the cloud.

2.4.4 Results

Haze. Average values of the haze transmission calculated from observations entered in Eq. (20), the volume absorption coefficient, K , and the optical depth, $K\Delta Z$, are summarized in figure 2. These observations through Eq. (19) provide the curve of K . The optical thickness, $K\Delta Z$, is calculated and appears at integer values of the geometric depth of the dust. The mean value of K is $0.042 \pm 0.009 \text{ km}^{-1}$. However, the rms deviation is only 0.0035 km^{-1} .

The smooth nature of the transmission and more important of the absorption coefficient suggests a uniform distribution of the atmospheric dust load. Error limits of observations and calculations are given by the

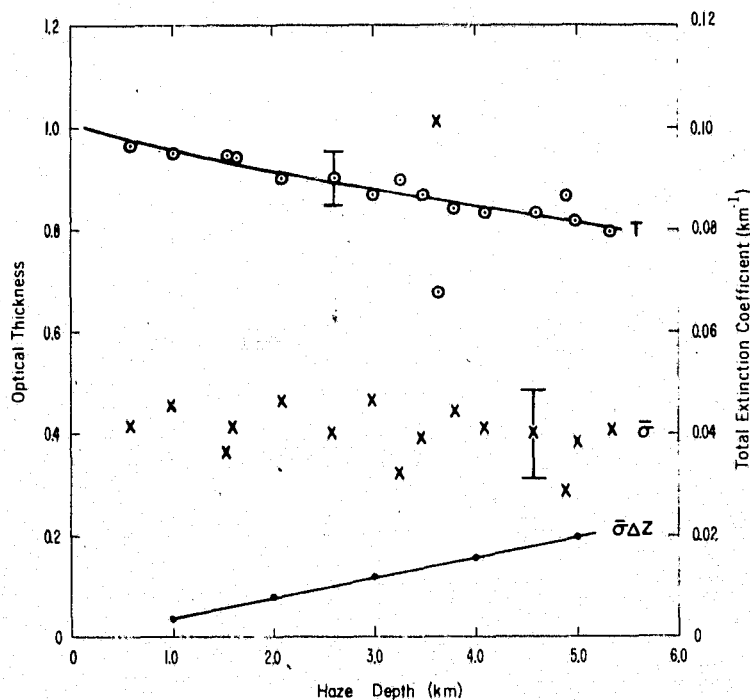


Figure 2. Haze transmission, volume absorption coefficient relative to haze depth and optical depth. Data used are from White Sands, New Mexico, 11 and 12 August 1973.

the vertical arrows. The narrow range of variations in these optical properties is in contrast to the much wider range of variation in clouds. Haze IR properties are an order of magnitude less, numerically, than those of middle clouds. The assumption is further made that the dust particles are uniformly less than a micron in diameter.

Middle Clouds. Table 3 lists the observed and derived optical properties of tropical middle altitude clouds and may be compared with the prior research of Platt (1974). In fact the cloud observations and calculations were made as a result of Platt's excellent work with his lidar.

In the last two sets of As values, the large values of K, the high emission, and the strong absorption indicate that the clouds were composed of large numbers of supercooled water droplets. It is also evident that a mixture of ice crystals and water as well as various particle densities causes the range in the values of K. However, there is a tendency to relate moderately deep, ice crystal clouds with K values $<1.0 \text{ km}^{-1}$ and shallow dense altostratus, water droplet clouds with K values $>7.0 \text{ km}^{-1}$. They are apparently composed mainly of ice particles with some supercooled water droplets evidenced by their lower values of K ($K < 1.00 \text{ km}^{-1}$) as suggested by Platt (op. cit.).

Table 3. Observed and Derived Cloud Optical Properties

Cloud Type	Depth (km)	Mean Height (km)	Mean Temp (°C)	τ^*	ϵ_N	K
As-Ac	1.5	6.4	-11.8	0.42	0.58	0.58
As	0.6	6.25	-11.0	0.63	0.37	0.77
As	2.0	6.4	-11.8	0.25	0.75	0.69
As-Ac	2.0	6.2	-10.0	0.23	0.77	0.73
As	0.4	5.7	- 7.0	0.04	0.96	8.06
As	0.3	5.2	- 4.5	0.07	0.93	8.86

*Calculated from Eq. (3) as an average of ten observations of $N_2\uparrow$, $N_{22}\uparrow$ and $N_c\uparrow$.

2.4.5 Calculated Cooling Rates

Atmospheric Haze. The NOAA RADIANCE program discussed in Section 2.3 has provisions for computations involving various aerosol layers such as cloud or haze, providing the volume absorption coefficient is known.

To calculate cooling rates through a haze layer, a temperature/pressure/humidity profile over White Sands, New Mexico, for 11 August 1973 was input to the RADIANCE solution. Figure 3 is a plot of the results, which provide calculated IR cooling rates at the midpoints of each layer in the haze and a corresponding haze-free and cloudless cooling rate profile.

The computations of infrared cooling show the cooling to average only $0.009^\circ\text{C hr}^{-1}$ throughout the haze layer. An absorption coefficient of 0.042 km^{-1} , as determined from observations, was used (Fig. 2). This cooling may be easily balanced by solar warming in the layer. This cooling rate would hardly alter the dynamics of the haze layer.

Middle Clouds. Radiometersonde profiles through middle altitude altostratus and altocumulus clouds furnished the RADIANCE calculation input to determine cooling rates through these clouds. Absorption coefficients from Table 2 were employed in two examples with calculated cooling rate curves appearing in figure 4. The curves are labeled, cloudless, $K=0.77$ and $K=0.8$. Cloud bases and tops are indicated for the two calculations.

Moderately deep clouds with $K < 1.00$ exhibit calculated cooling rates of up to $0.23^\circ\text{C hr}^{-1}$, not enough to alter the cloud stability. In contrast, shallow dense clouds of water droplets with $K \approx 8.0$ display calculated cooling rates of approximately $0.15^\circ\text{C hr}^{-1}$. Such a cooling rate could have an effect on cloud stability.

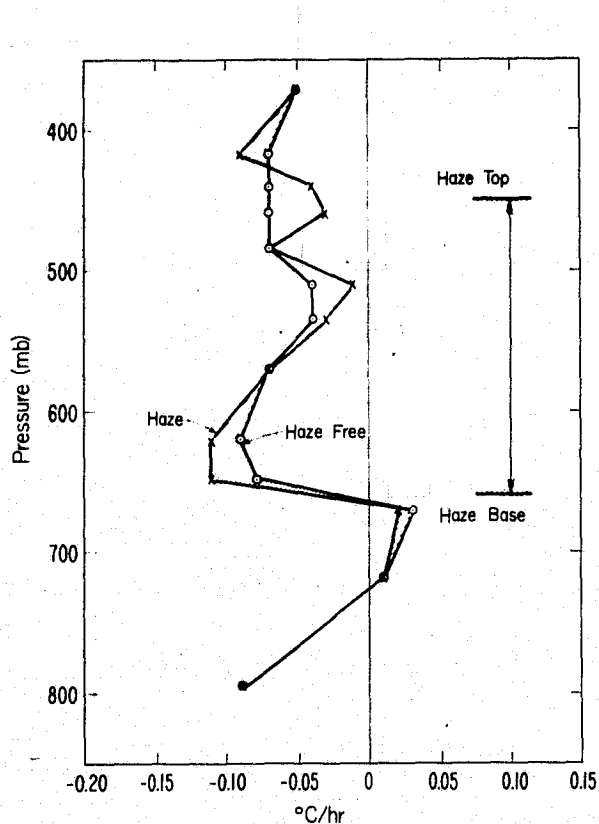


Figure 3. Calculated IR cooling in haze, 11 August 1973, 2130 UT, over sand dunes, White Sands, New Mexico.

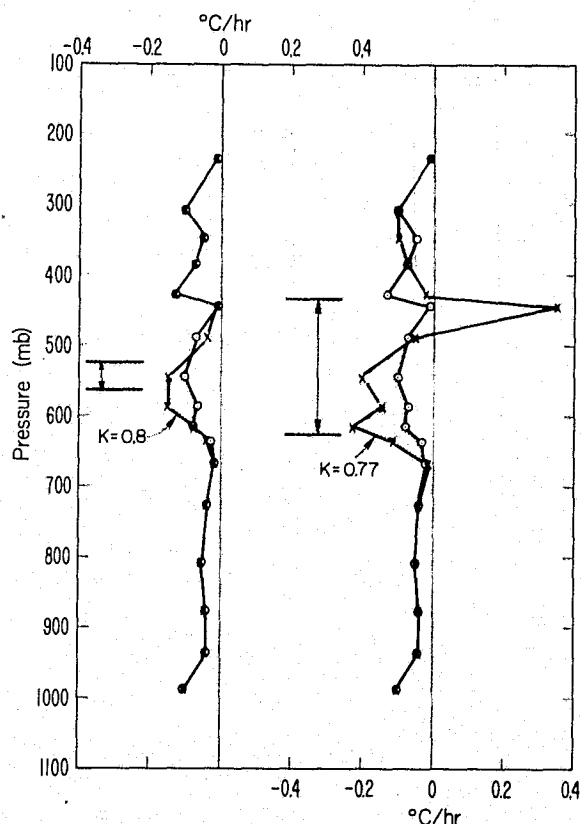


Figure 4. Calculated IR cooling through thin and deep middle clouds, 8 August 1973, 1937 UT over Rosenberg, Texas, oil fields.

2.4.6 Conclusion

It would appear important now to combine IR cooling rates for atmospheric absorbers with solar heating to complete the radiation budget analyses for both cloudless and cloudy and hazy atmospheres. Also the bulk radiative transfer approach employing a volume absorption coefficient determined in the atmosphere for non-gaseous absorbers and combined with a mass absorption coefficient (cm^2g^{-1}) for the gaseous absorbers provides a simple and rapid computer solution. In cloud or in haze, scatter of radiant emission was assumed negligible but the nature of the observations would appear to validate the use of the experimentally determined absorption coefficient in the presence of haze or cloud. A classification of absorption coefficient in relation to various cloud types and depths as well as to various haze or dust layers could now be attempted from the large amount of data available. Further, sufficient simultaneous haze and cloud composition and IR observations exist to attempt this classification as input to radiative transfer calculations for future improved input to numerical weather models.

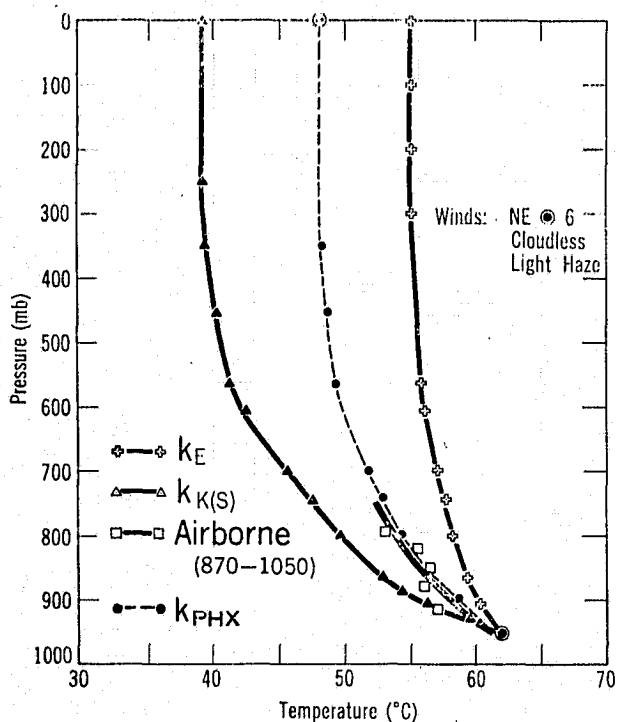


Figure 5. Profiles of surface temperature from helicopter airborne observations, and as calculated with a transfer model, using Elsasser's table (K_E), Smith's table ($K_{K(S)}$), and this study's Phoenix bulk coefficient (K_{PHX}).

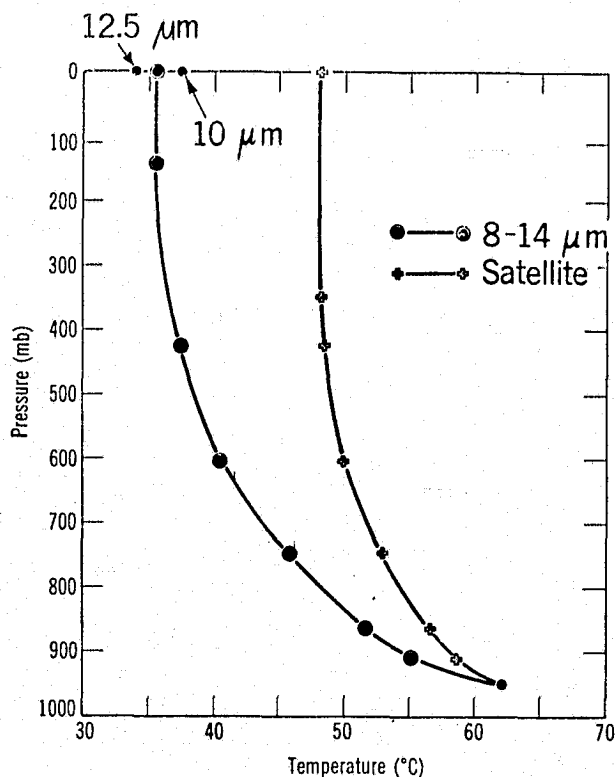


Figure 6. Calculated brightness temperatures.

The special effects of a heavily dust laden atmosphere on the magnitude of the bulk total extinction coefficient for the 11.0 - 11.1 μm spectral interval are evident after a review of figure 5. This figure illustrates calculated and observed brightness (apparent) surface temperatures as a function of height over Rainbow Valley (Phoenix, Arizona). The differences among the calculated and observed profiles clearly demonstrate the necessity of obtaining "K" for a unique area.

Figure 6 illustrates the calculated brightness temperatures at 10.0 and 12.5 μm and at 8 to 14 μm . A computation using 11.0 to 11.1 μm gives a curve close to the satellite curve. It also agrees with calculations made with the Phoenix area determined total extinction coefficient.

Figures 7 and 8 show the sites of the measurements used in figures 5 and 6. Figure 9 summarizes the various bulk total extinction coefficients employed in calculations. K_{TOT} for this paper provides the best results when compared with S-191, 11.0 - 11.1 μm channel. Note that $\nu(\text{cm}^{-1})$ is the inverse of the wavelength in microns.



Figure 7. SKYLAB photomap of Phoenix, Arizona, area.

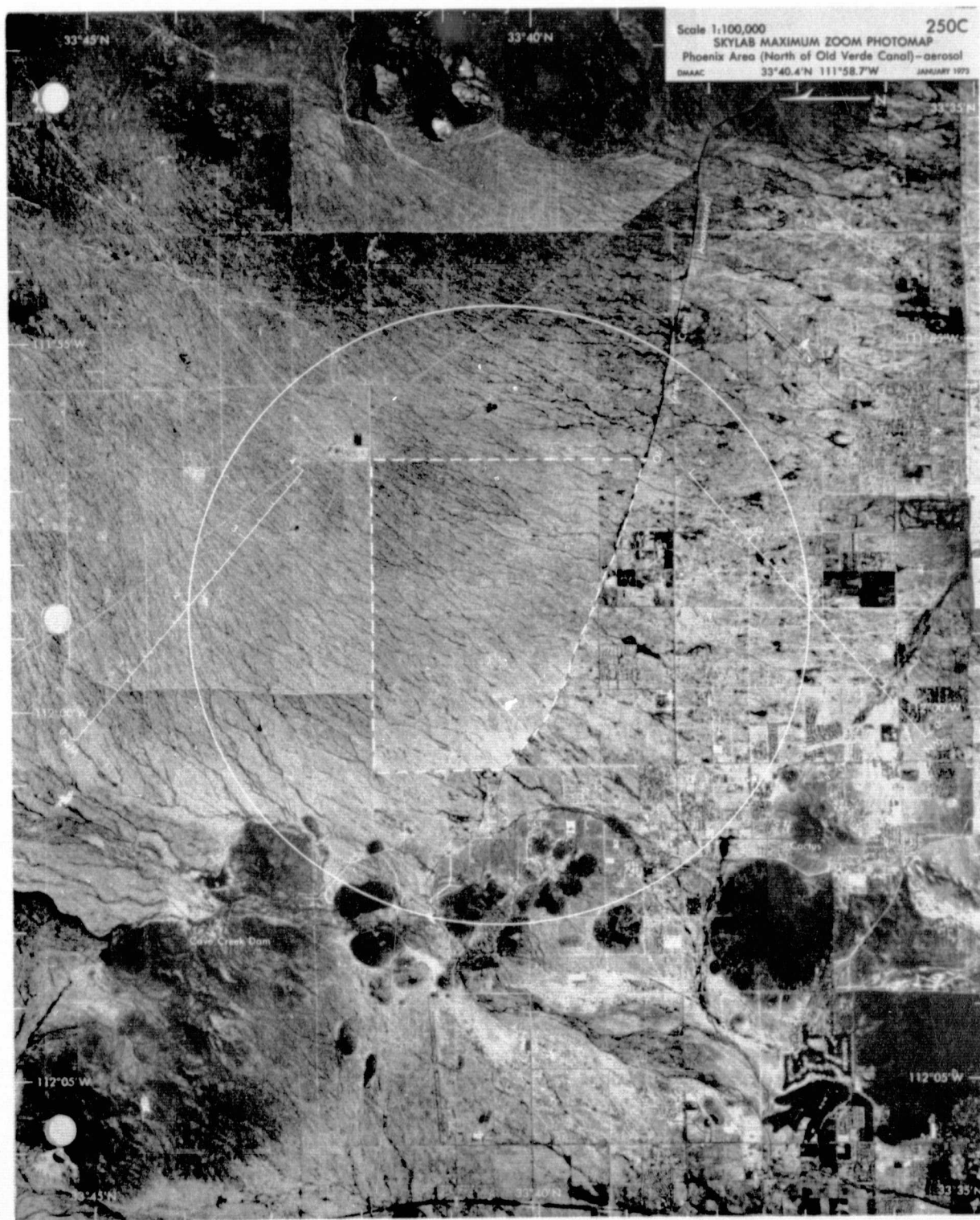


Figure 8. SKYLAB photomap of Phoenix area north of Old Verde Canal.

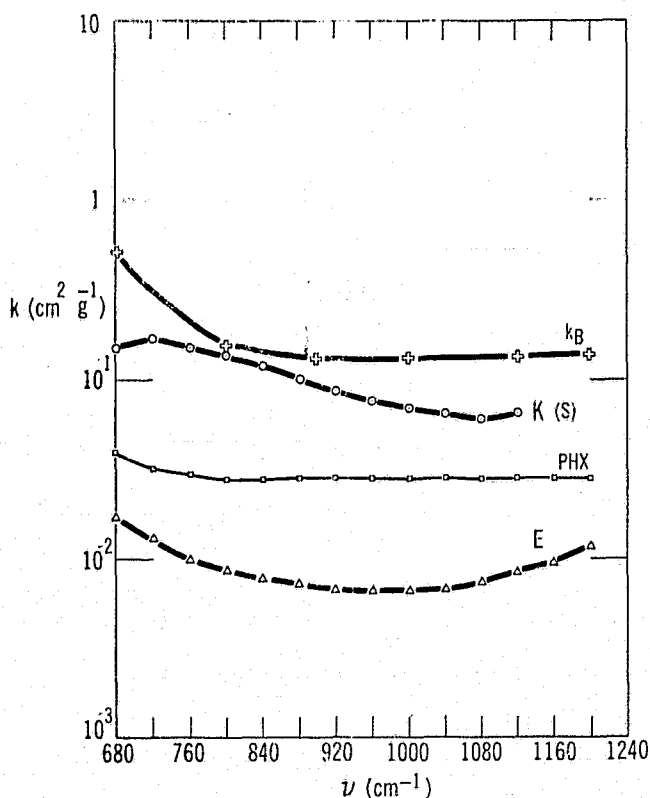


Figure 9. Total extinction coefficients (cm 2 g $^{-1}$) according to Bignell (k_B), Kuhn utilizing Smith CO $_2$ tables ($K(S)$), Kuhn utilizing Elsasser CO $_2$ tables (E), and this study (PHX).

2.5 Absorption of Tropospheric Aerosols: Urban and Rural Aerosols of Phoenix, Arizona

The infrared optical properties of aerosols around Phoenix, Arizona, were studied to evaluate the effects of the interaction of atmospheric particulate matter with long wave radiation. This was accomplished by collecting aerosols on membrane filters at 500 m msl that had air asperated through them at a controlled rate. A Gardener fine particle counter was run concurrently. Filter samples were then analyzed for particle sizes by a scanning electronic microscope. The aerosol absorption coefficient was calculated according to Mie theory. By measuring the aerosol layer transmission, the bulk total extinction coefficient was determined. Further calculations show that at 10 μ m wavelength, more than 95 percent of the infrared extinction is caused by absorption. The imaginary part of the infrared refractive index of 0.47 for urban and 0.19 for rural aerosols was calculated by Pueschel and Kuhn (1975).

2.6 Discussion and Conclusions of the Surface and Boundary Layer Experiment

This field program, under EREP SKYLAB overpasses of selected sites, was designed to achieve three primary objectives:

1. Provide in-situ balloon-borne radiometersonde observations of total (infrared plus solar) upward and downward irradiance (flux) from the surface to 35 km for comparison with and verifications of selected atmospheric radiative transfer models. These results were correlated with the S-191 broad-band data.
2. Determine the mass absorption coefficient (cm^2g^{-1}) in the atmospheric window (8.0 to 14.0 μm , 714 to 1250 cm^{-1}) by direct relating of S-191 11.0 to 11.1 μm (900 to 910 cm^{-1}) brightness temperature observations to surface and helicopter radiometric observations in the same spectral band.
3. Provide interface (air-surface) observations of net total radiation, net total insolation reflected insolation, downward insolation and albedo for calibration, ground baseline, and comparison with S-191, S-192, airborne, and balloon-borne radiometric observations.

Conclusions relative to the first objective were that the balloon radiometersonde, a device flown successfully since 1957, does provide a comparison for radiative transfer models that is at least as accurate as the models. Deviations of radiative flux and intensity calculations are due to inadequate knowledge of real atmosphere transmission. The SKYLAB S-191 radiometer was vital in providing correlative atmospheric long wave intensities (radiance) in the center of the atmospheric window region.

Relative to the second objective, it was possible to determine the mass absorption coefficient of the atmosphere over at least the Phoenix site in the 8 to 14.0 μm (714 to 1250 cm^{-1}) spectral band and in the 11.0 to 11.1 μm (900 to 910 cm^{-1}) spectral band by combining observed S-191 brightness (radiance) temperatures with balloon radiometric and helicopter radiometer data. This results from in-situ field observations requiring the S-191 observations is important in that it provides parameters required for proper atmospheric radiative transfer under a typical desert southwest atmosphere under summer conditions.

The third objective, that of providing ground baseline observations for S-191 and S-192, basically a data-base effort, was also achieved.

3. AIRCRAFT EXPERIMENT

3.1 Comparison of Models For Computing Atmospheric Infrared Transmission

Various models were used in describing the primary differences in transmissiveness of gaseous constituents of the atmosphere. Among them were RADIANTV of Colorado State University and RADIANCE of the NOAA, Environmental Research Laboratories. These include options for computing

radiation transmission including ozone, aerosol, and continuum as well as water vapor and carbon dioxide transmissions.

These models were then compared with SKYLAB infrared spectrometer data. It was shown that all models are capable of computing atmospheric absorption and emission from the earth's surface to within 5 percent accuracy. The models are described in detail in Renne and Marlatt, 1975.

3.2 Spectral Estimates of Albedo and Comparison to SKYLAB Observations

An application of the "adding" or "doubling" method has been made for homogeneous atmospheric layers composing an inhomogeneous atmosphere (Raine and Marlatt, 1975). The lower layer was assumed to be composed of silicate particles of complex refraction index $1.55 - 0i$ corresponding to a wave length of $0.5 \mu\text{m}$. The particle size distribution was measured on site. The upper layer was assumed to be a gaseous layer scattering light in accordance with Rayleigh's phase function. Radiance values were computed for a planetary system composed of the described atmospheric layer overlying a Lambert reflecting ground. These values show a fairly good agreement with the SKYLAB observations given a reasonable knowledge of the scattering (or reflecting) properties of the atmosphere and ground.

3.3 Conclusions

This field program at aircraft level was designed to determine the accuracy and applicability of a number of radiative transfer models for the atmosphere by comparing values from the models in conjunction with observations from the SKYLAB spacecraft, from balloon radiometersondes, and from surface radiometers.

Note that the transfer models studied covered, basically, the same frequencies of the spectrum as were employed in the S-191 and S-192 SKYLAB radiometers. In fact the 11.0 to $11.1 \mu\text{m}$ ($900 - 910 \text{ cm}^{-1}$) band of S-191 was basic to transfer calculations in this atmospheric window region, providing interface brightness (apparent) and physical temperatures. The S-192 data provided the areal background imagery for verification.

The results of this study were: (1) Each of the models tested was able to compute the long wave radiation emitted from the earth's surface to an accuracy of 5 percent of observed radiance. (2) The models were all most sensitive to input parameters, especially surface temperature, water vapor and ozone. (3) Particularly in dry atmospheres, all models tended to overestimate the opacity of the atmosphere in the $8-14 \mu\text{m}$ band-pass.

4. DISCUSSION AND CONCLUSIONS DERIVED FROM SCARP

The SKYLAB Concentrated Atmospheric Radiation Project succeeded in utilizing radiometric observations from the SKYLAB Earth Resources Experiment Package. Its primary goal was to arrive at a more complete description

and model of radiation transfer within the atmosphere by employing in-situ satellite, aircraft, ground, and balloon-borne radiometric observations. Specifically an attempt was made to determine the applicability of a variety of radiative transfer calculation models computing radiative flux in air masses of different character, i.e., varying amounts of wet and dry aerosol burden, varying interface types, and varying temperature and humidity profiles.

The method of comparison was one of obtaining in-situ SKYLAB S-191 and S-192 observations, aircraft and balloon-borne profiles of upwelling and downwelling radiance and irradiance, and ground-base observations of net and total infrared and solar radiation. Having temperature and humidity sounding profiles under the EREP overpasses, we ran the transfer calculations in both the solar and infrared spectra and compared them with the in-situ observations. The field data for comparisons were good and these data sets are available for further research, either as computer plotted graphs in this report or as card and/or tape data sets. Printer output is also readily available. From this basic effort one may conclude that, direct observations are superior to present transfer calculations, and this is because of a lack of knowledge of complex atmospheric transmission.

This comparison of several existing infrared radiative transfer models under somewhat controlled conditions and with the above atmosphere observations of SKYLAB's S-191 and S-192 radiometers illustrated that the models tend to over-compute atmospheric attenuation in the window region of the atmospheric infrared spectra. Add to this the variability of radiance calculations from the different models, all with identical input data, and one is led to the conclusion that much further research on in-situ atmospheric transmission observations and calculations is a necessity. This is further evidenced by inaccuracies in satellite temperature and humidity profile specifications from an inverse solution to the transfer equation. In this connection atmospheric transmission functions for at least the Phoenix summer atmosphere appear to have been determined.

A basic recommendation for future studies would be to employ the SCARP accumulated satellite, aircraft, and balloon platform acquired data in an attempt to determine atmospheric, broad-band transmission coefficients for the Phoenix and Houston areas. This could be accomplished from the data set on hand and could serve the radiative transfer modeling community well. Such an undertaking could be undertaken for little more than computer costs and some salary budgeting.

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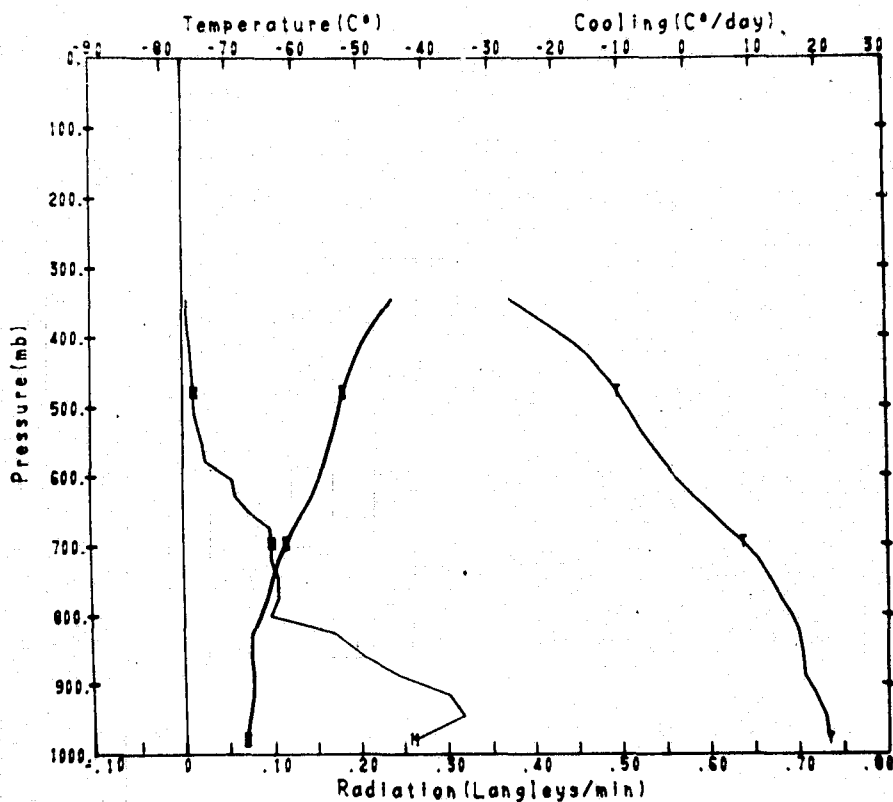
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APPENDIX A

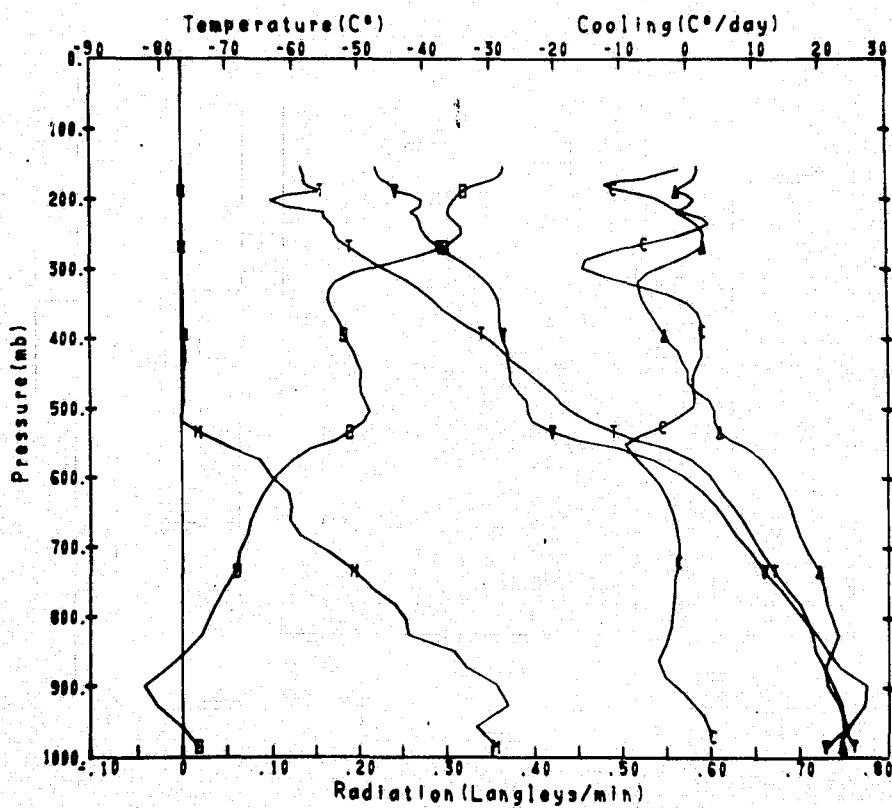
Plots of Observed Radiation Flux Profiles
During SKYLAB

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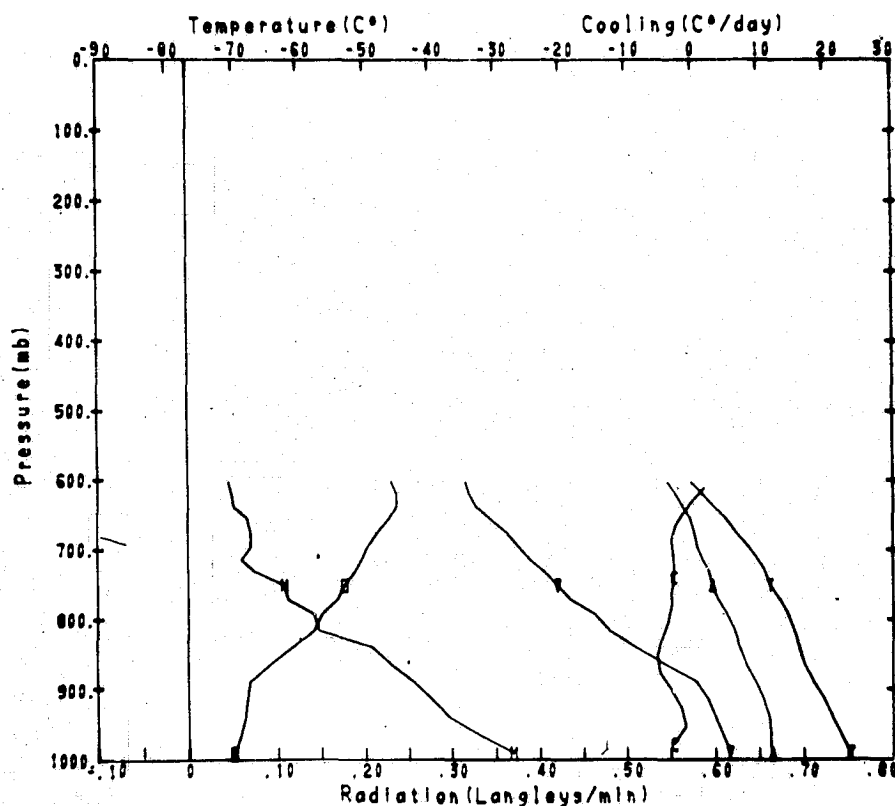
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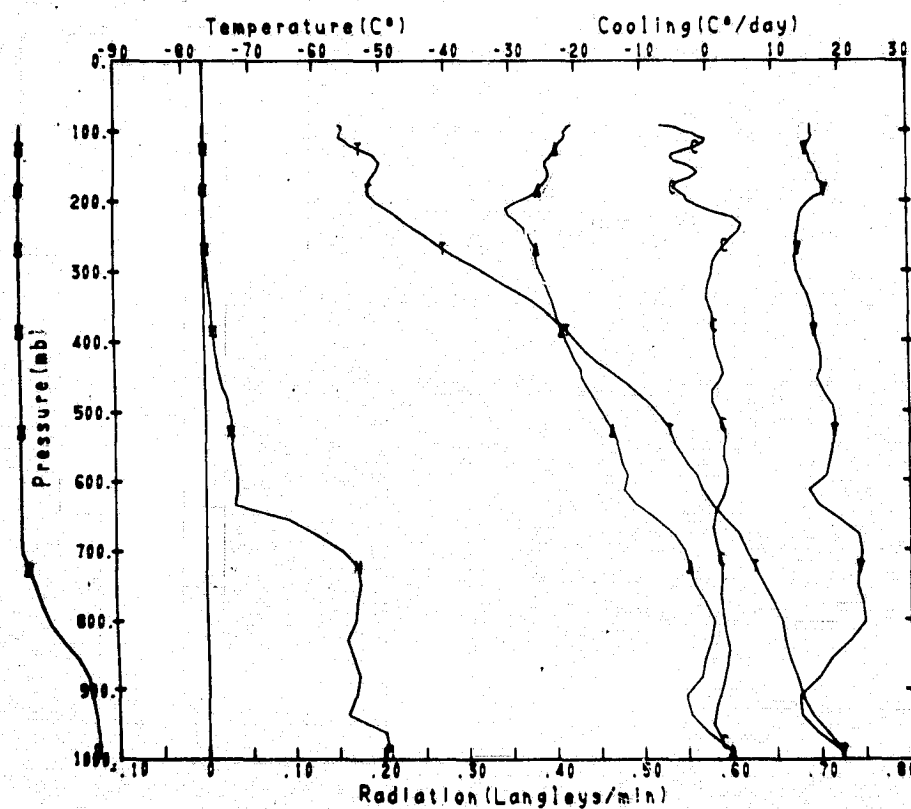
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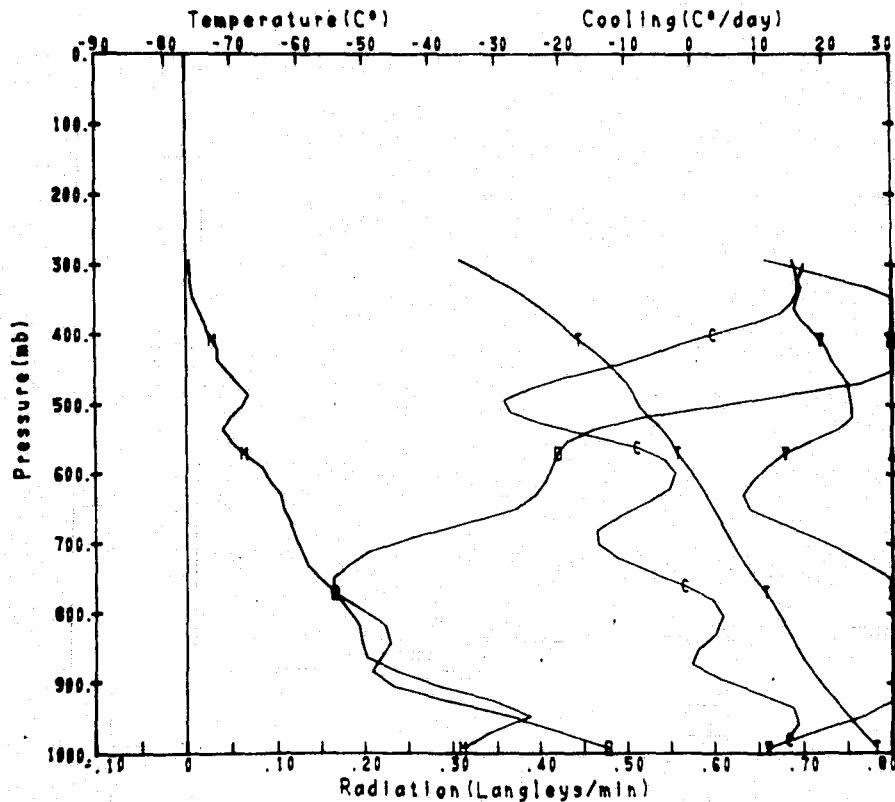
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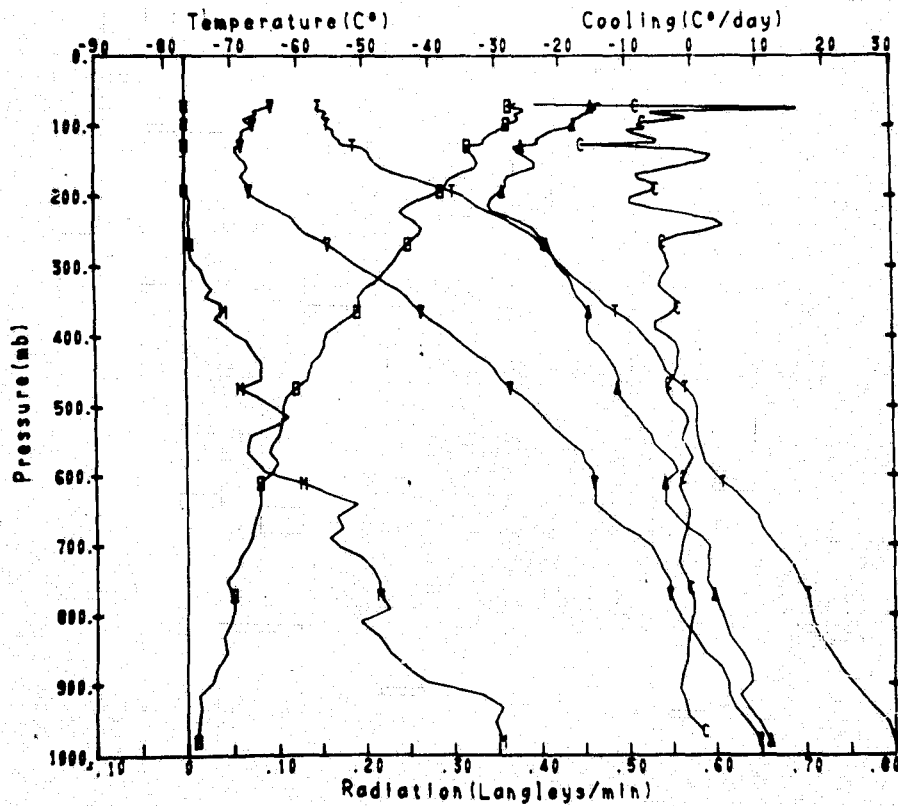
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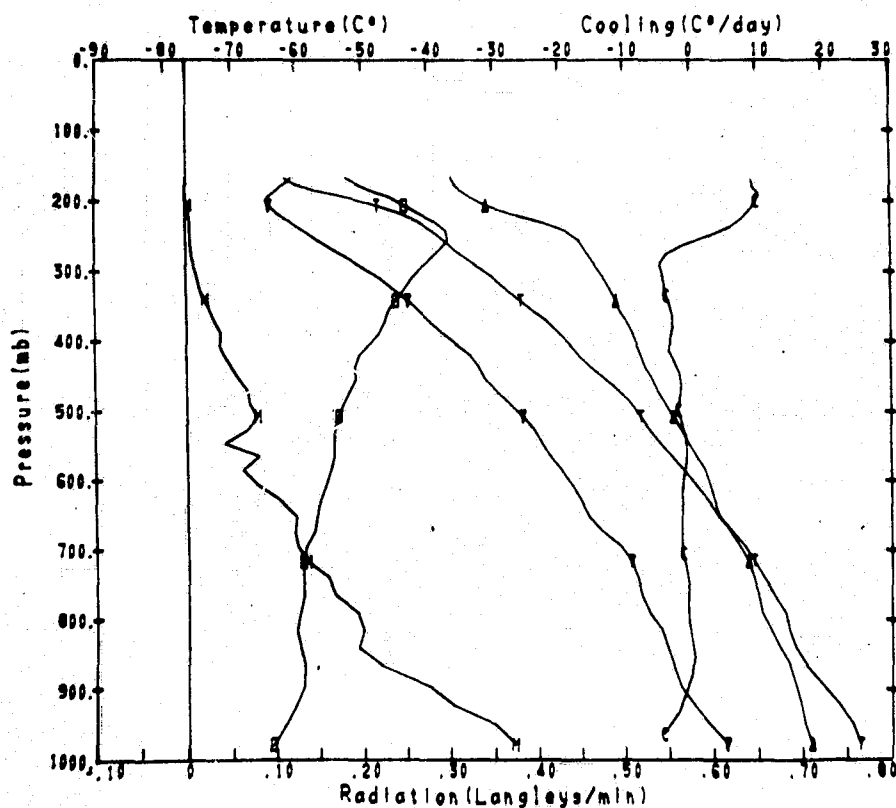
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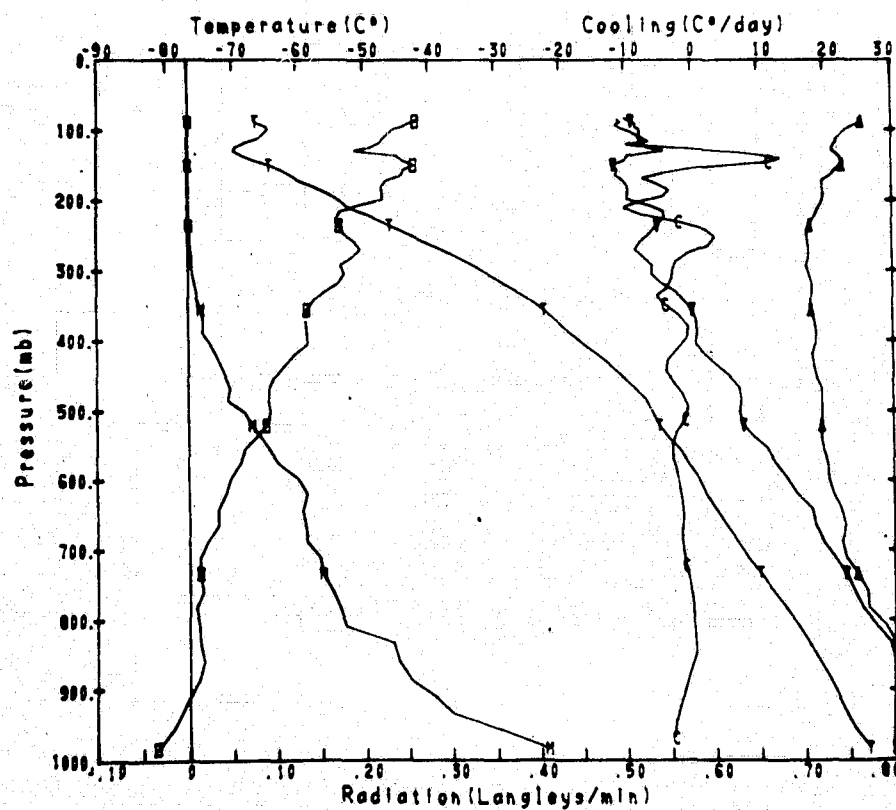
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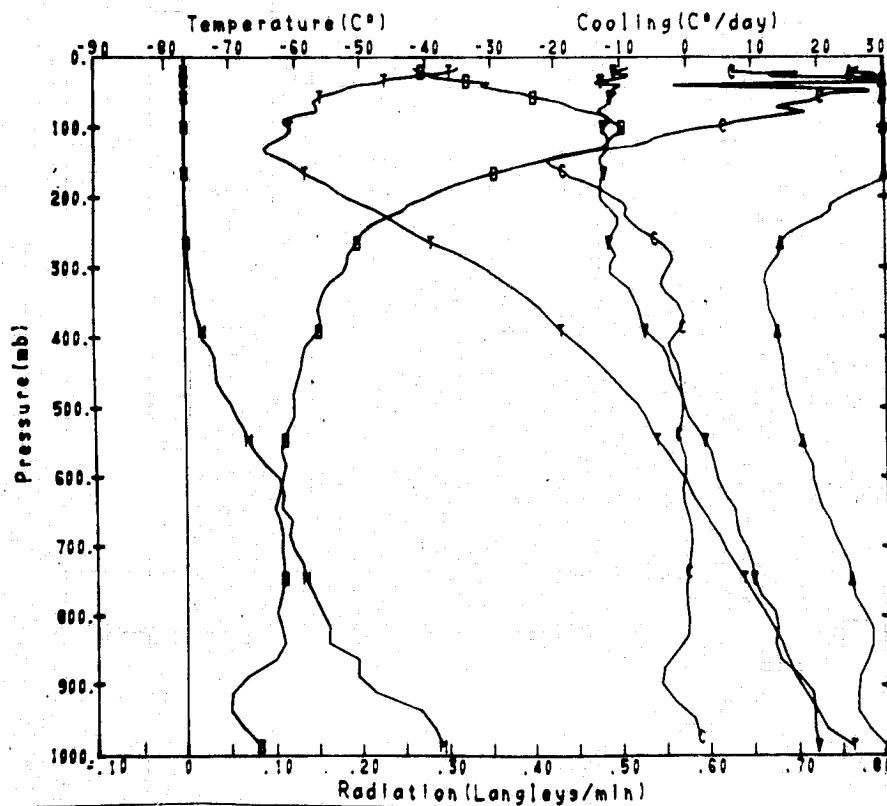
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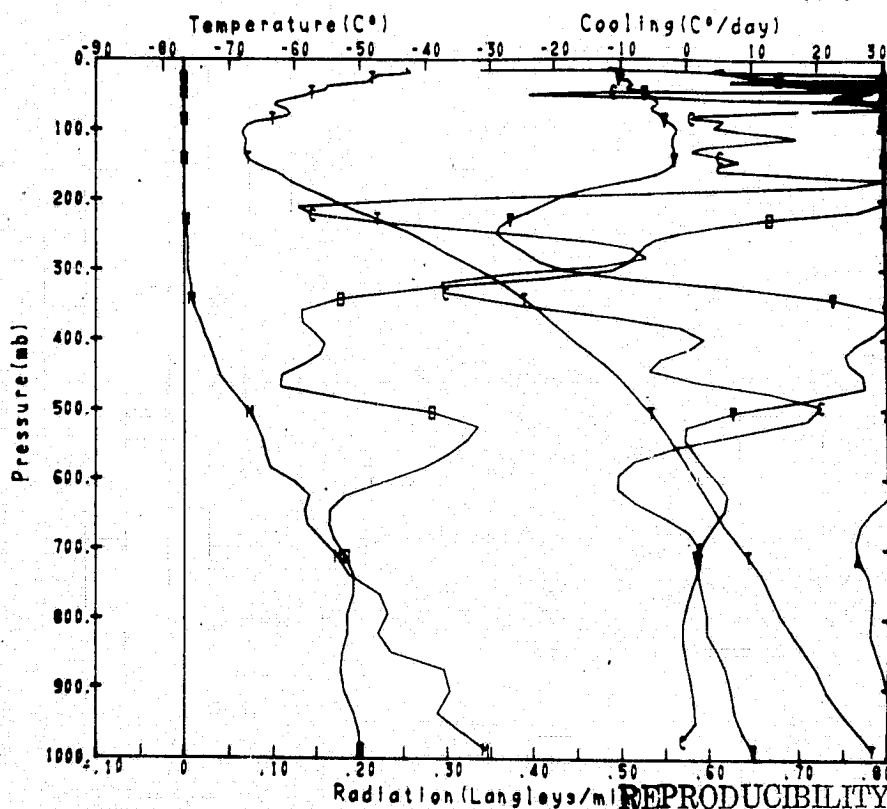
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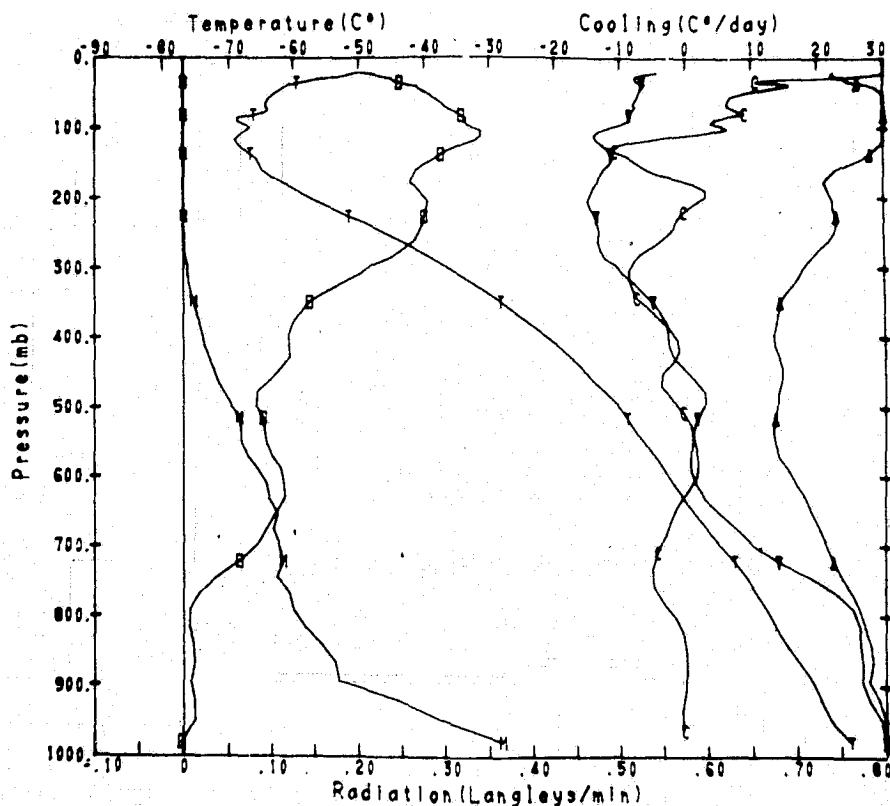


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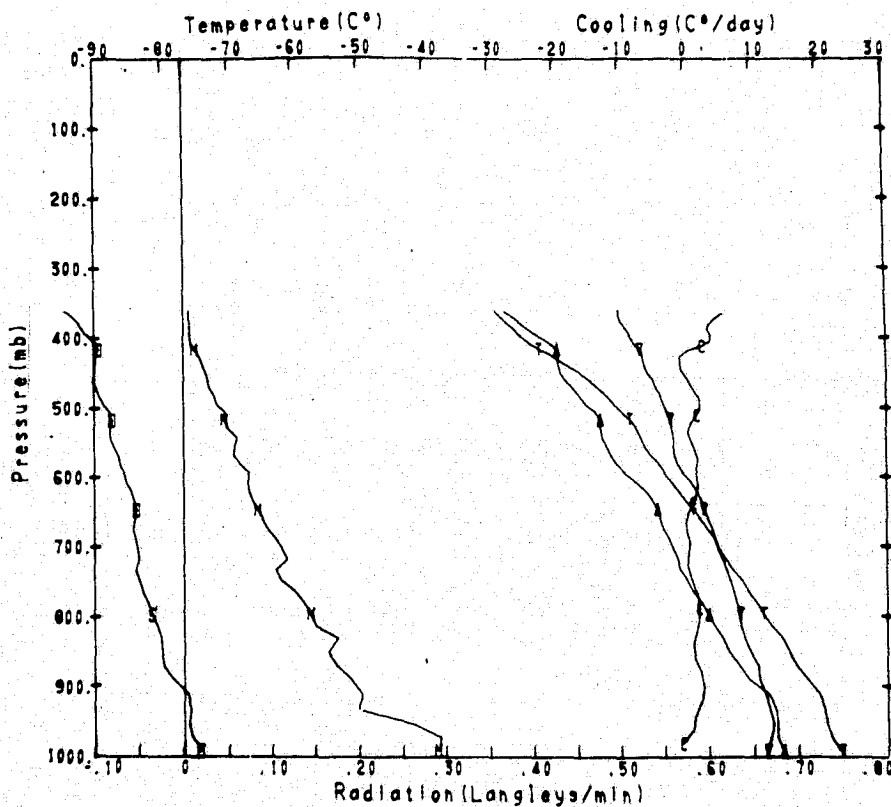


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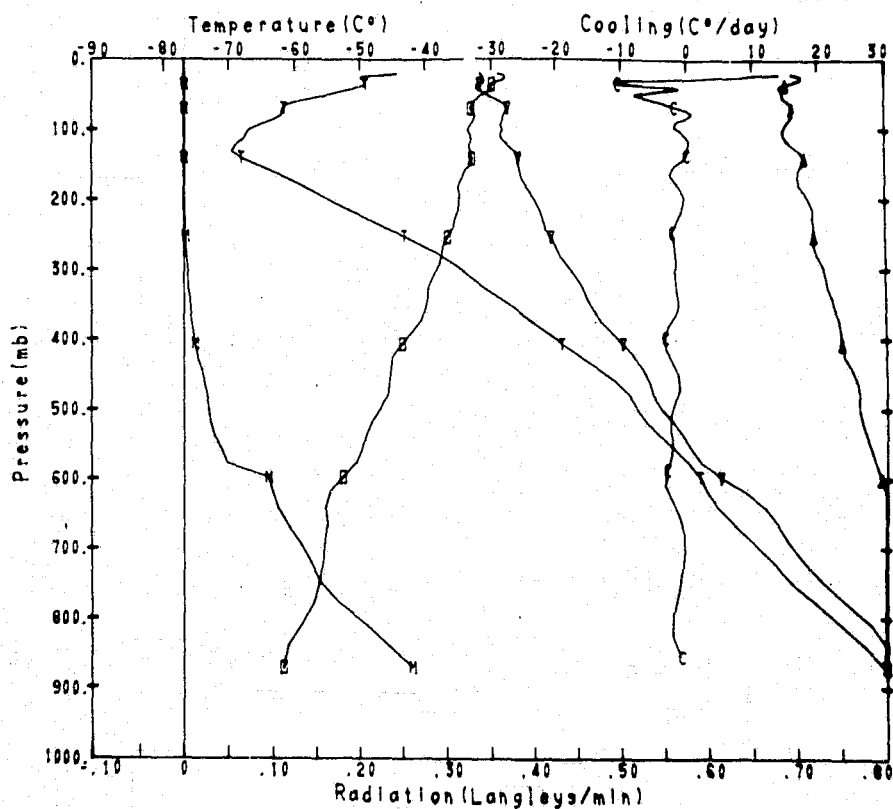
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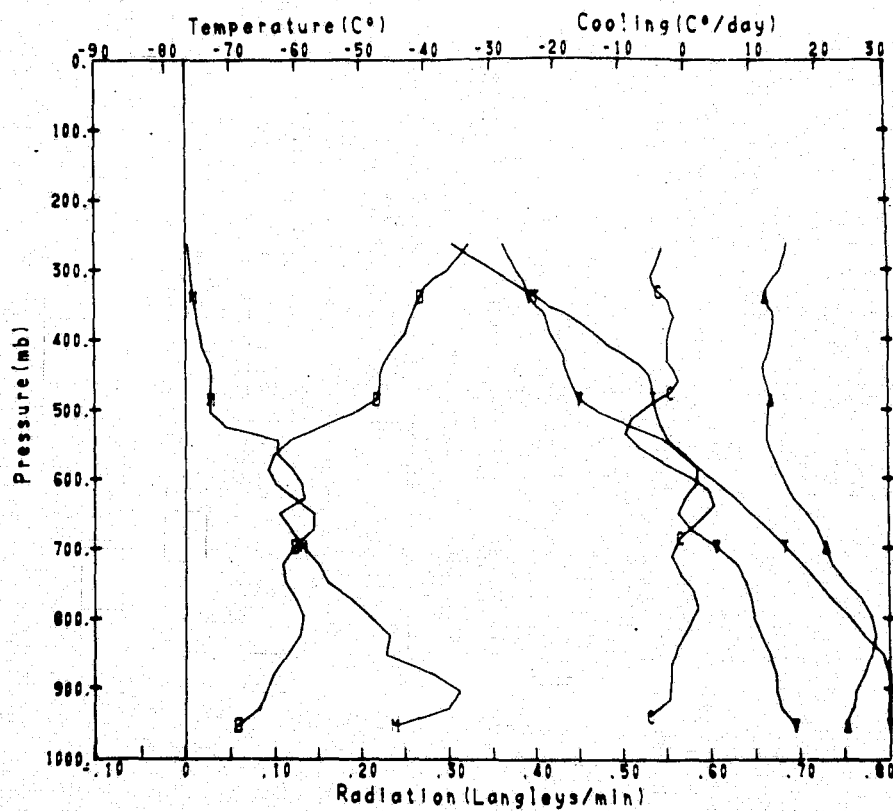
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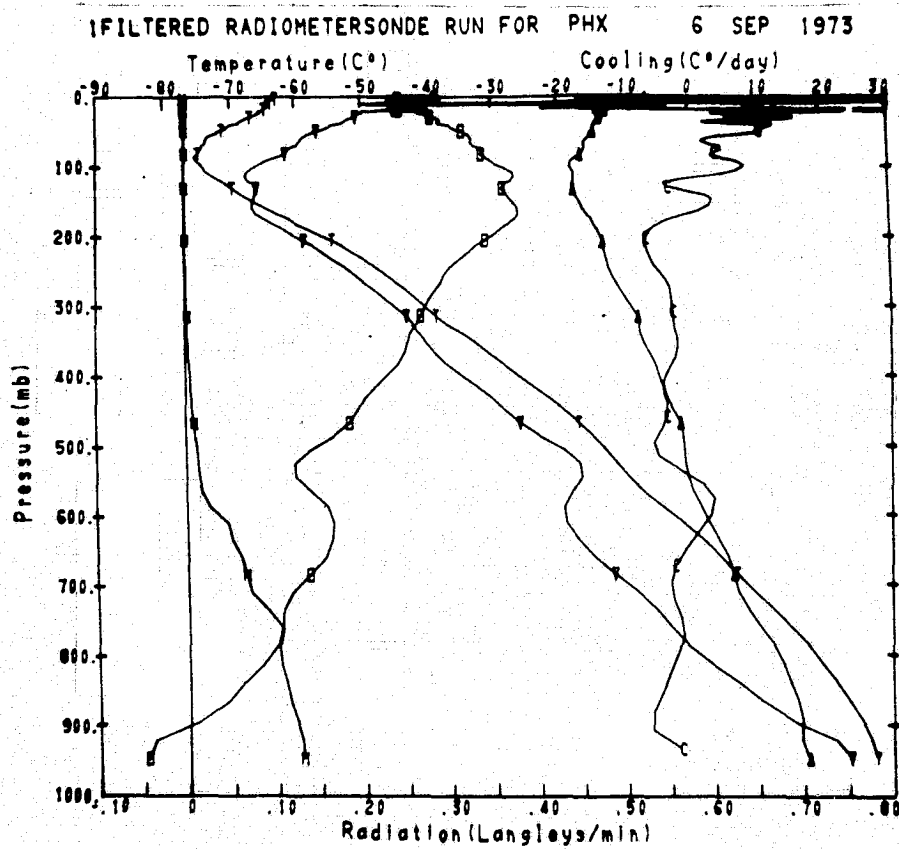
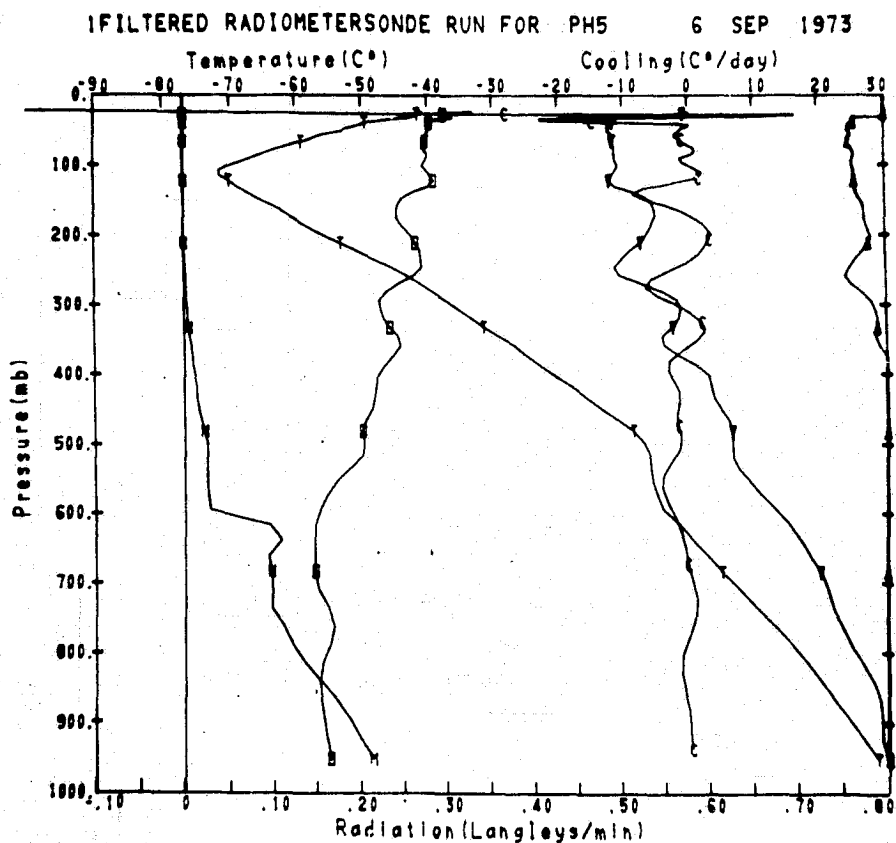


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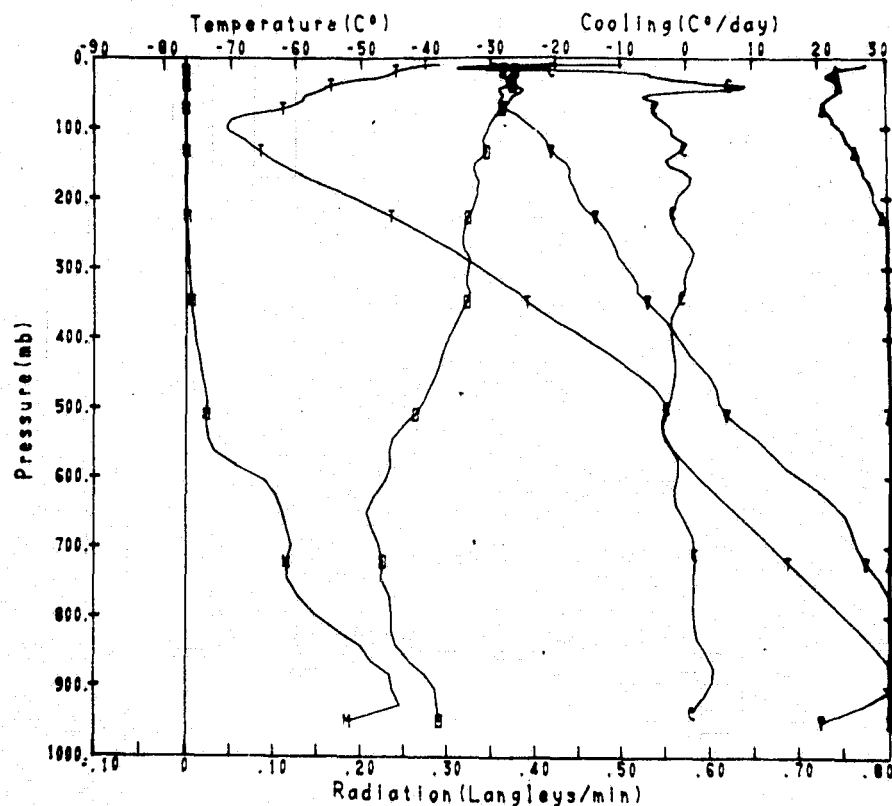
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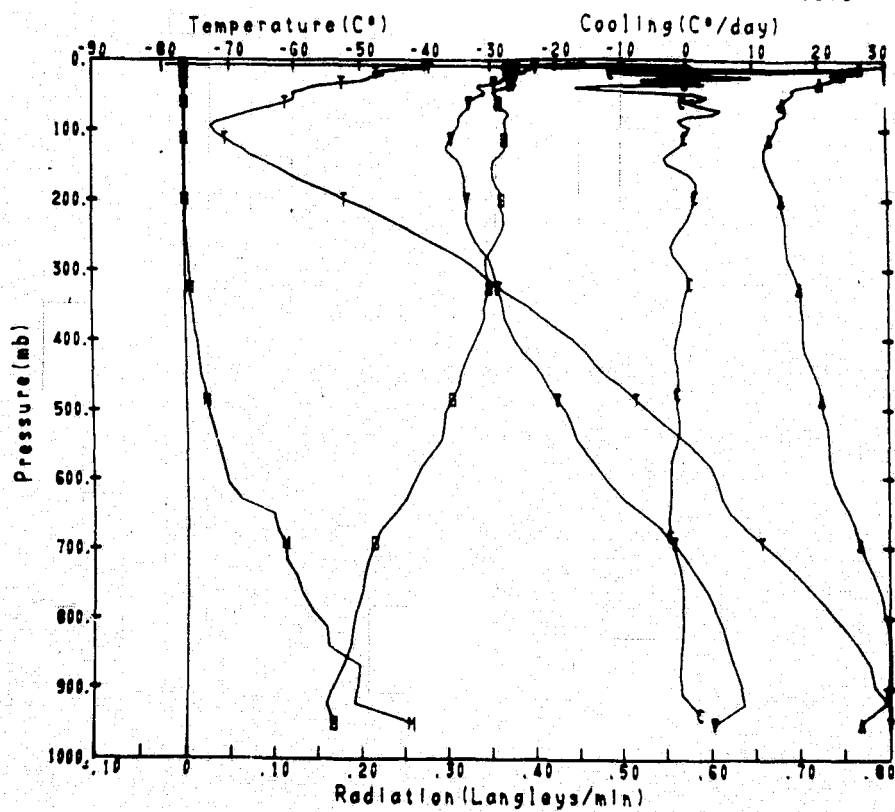


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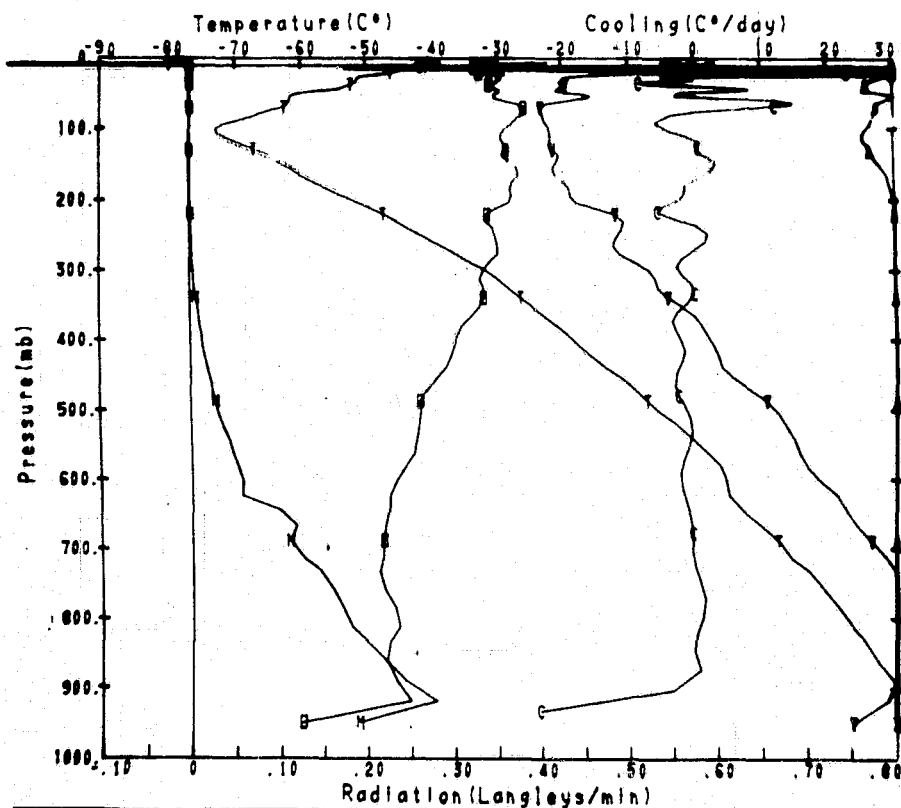
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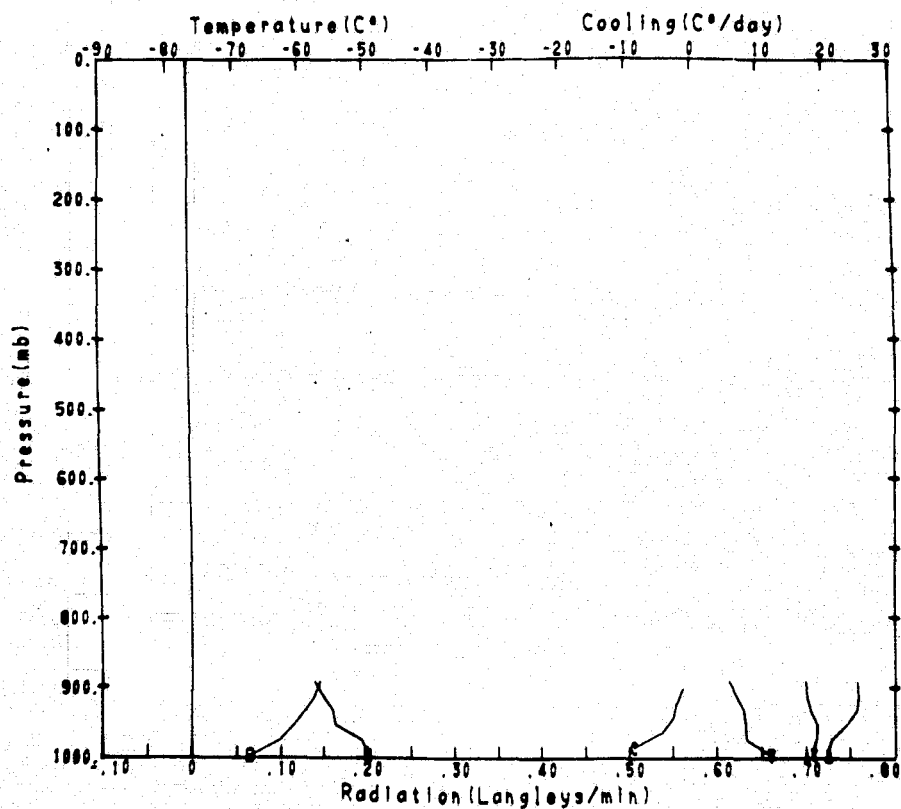
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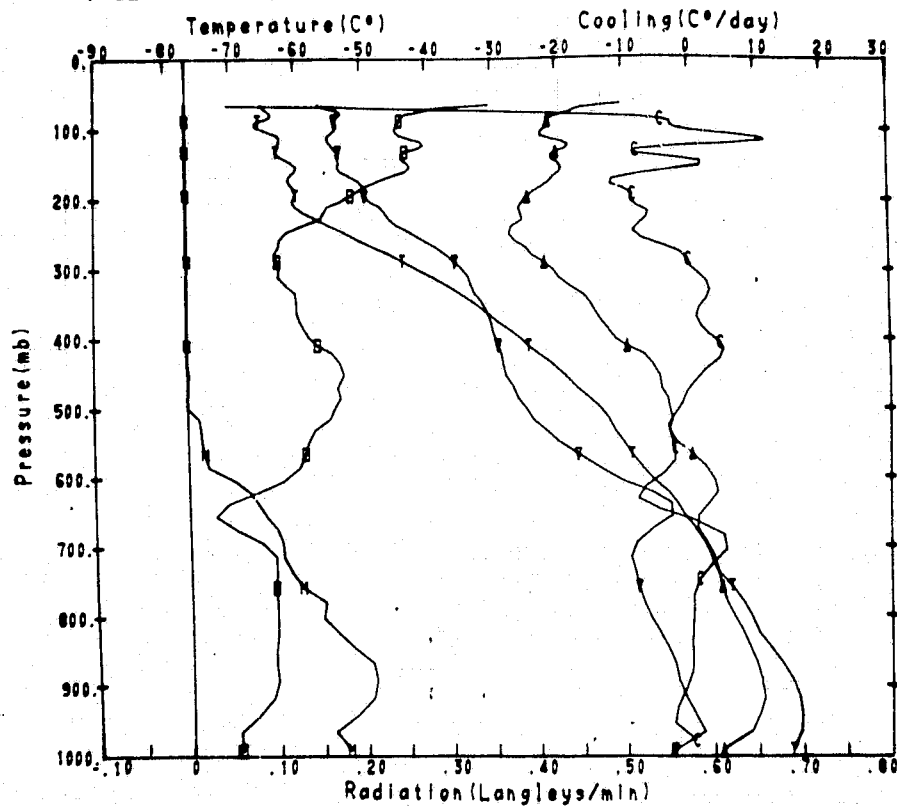
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APPENDIX B

Data Listings of Observed Radiation Profiles During SKYLAB

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

1FILTERED FANIDMETERSONDE RUN FOR RND 4 JUN 1973 OPUS 1								
PRESS (MM)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
1017.1	0.0	20.8	0.0548	0.3548	0.0000	0.0	11.910	77
930.3	1.0	21.3	0.0288	0.0288	0.0000	0.0	13.036	81
946.5	2.0	20.8	0.0724	0.0724	0.0000	0.0	15.843	92
915.6	3.0	19.3	0.0766	0.0766	0.0000	0.0	15.024	99
887.9	4.0	17.6	0.0772	0.0772	0.0000	0.0	12.170	85
858.5	5.0	17.3	0.0756	0.0756	0.0000	0.0	10.583	70
828.0	6.0	16.9	0.0771	0.0771	0.0000	0.0	8.523	57
802.3	7.0	15.7	0.0857	0.0857	0.0000	0.0	4.323	35
776.2	8.0	14.0	0.0928	0.0928	0.0000	0.0	5.247	40
748.2	9.0	12.4	0.0993	0.0993	0.0000	0.0	5.248	43
720.1	10.0	10.6	0.1060	0.1060	0.0000	0.0	4.980	43
697.5	11.0	8.3	0.1145	0.1145	0.0000	0.0	4.926	49
675.1	12.0	5.8	0.1240	0.1240	0.0000	0.0	4.807	57
652.0	13.0	3.3	0.1342	0.1342	0.0000	0.0	3.680	49
629.3	14.0	0.7	0.1446	0.1446	0.0000	0.0	2.337	46
605.2	15.0	-1.7	0.1532	0.1532	0.0000	0.0	2.825	51
579.1	16.0	-3.8	0.1600	0.1600	0.0000	0.0	1.273	25
553.9	17.0	-5.6	0.1657	0.1657	0.0000	0.0	1.140	25
530.8	18.0	-7.3	0.1711	0.1711	0.0000	0.0	0.889	21
511.3	19.0	-8.5	0.1757	0.1757	0.0000	0.0	0.697	17
494.4	20.0	-9.6	0.1786	0.1786	0.0000	0.0	0.655	18
480.3	21.0	-10.5	0.1813	0.1813	0.0000	0.0	0.638	18
464.4	22.0	-11.7	0.1860	0.1860	0.0000	0.0	0.605	18
447.6	23.0	-13.1	0.1918	0.1918	0.0000	0.0	0.551	18
429.5	24.0	-14.7	0.1966	0.1966	0.0000	0.0	0.521	18
411.1	25.0	-16.8	0.2038	0.2038	0.0000	0.0	0.452	18
393.5	26.0	-19.5	0.2127	0.2127	0.0000	0.0	0.383	18
377.6	27.0	-22.0	0.2215	0.2215	0.0000	0.0	0.332	19
361.7	28.0	-24.5	0.2302	0.2302	0.0000	0.0	0.287	20
346.2	29.0	-27.0	0.2388	0.2388	0.0000	0.0	0.242	20

1FILTERED FANIDMETERSONDE RUN FOR RND 5 JUN 1973 OPUS 3								
PRESS (MM)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
1011.5	0.0	25.0	0.0654	0.6529	0.0125	0.0	19.501	98
992.1	0.8	23.8	0.0652	0.6163	0.0489	-11.0	18.490	97
967.0	1.8	22.4	0.0643	0.6084	0.0559	-3.0	16.616	93
940.2	2.8	21.0	0.0617	0.5995	0.0622	-1.1	14.845	89
914.1	3.8	19.7	0.0653	0.5905	0.0649	-1.8	13.746	85
888.8	4.8	18.2	0.0663	0.5782	0.0681	-3.3	12.725	85
864.3	5.8	16.8	0.0356	0.5443	0.0913	-4.9	11.467	83
839.1	6.8	16.0	0.0277	0.5088	0.1189	-5.3	10.352	75
815.5	7.8	15.3	0.0221	0.4796	0.1426	-4.7	7.360	54
792.7	8.8	14.3	0.0133	0.4623	0.1510	-3.7	7.115	55
771.6	9.8	13.2	0.0031	0.4350	0.1681	-3.3	5.061	46
750.7	10.8	11.8	0.5965	0.4205	0.1760	-3.2	5.404	46
730.1	11.8	11.0	0.5923	0.4040	0.1889	-2.9	3.656	33
714.2	12.8	9.9	0.5859	0.3895	0.1962	-2.9	2.964	27
696.5	13.8	8.5	0.5798	0.3772	0.2027	-3.0	3.477	35
676.6	14.8	6.7	0.5775	0.3637	0.2138	-3.2	3.472	38
655.1	15.8	5.0	0.5724	0.3439	0.2285	-2.6	3.293	39
638.1	16.8	3.2	0.5635	0.3280	0.2356	-1.3	2.926	34
620.4	17.8	1.5	0.5556	0.3200	0.2356	0.0	2.423	35
602.9	18.8	-0.3	0.5466	0.3161	0.2304	1.7	2.283	37

11 FILTERED RADIOMETER SONDE PUN FOR RNB 5 JUN 1973 OPUS 5								
PRESS	TIME	T-AIR	F-UP	F-DN	F-NET	COOL	Q-MIX	R-HUM
(MB)	(MIN)	(DEG C)	(LY/MIN)	(LY/MIN)	(LY/MIN)	(DEG/DA)	(GM/KG)	(PC)
1017.1	0.0	27.6	0.7668	0.7451	0.0217	0.0	17.086	72
947.4	1.0	24.9	0.7474	0.7298	0.0176	0.8	17.745	93
957.5	2.0	23.2	0.7528	0.7537	-0.0009	3.5	16.584	88
926.3	3.0	22.9	0.7444	0.7729	-0.0285	2.2	18.466	95
898.3	4.0	21.6	0.7319	0.7749	-0.0431	-0.5	17.830	97
872.2	5.0	20.3	0.7287	0.7450	-0.0163	-3.6	16.053	95
849.1	6.0	19.1	0.7363	0.7311	0.0052	-4.7	15.354	90
826.2	7.0	18.6	0.7429	0.7199	0.0230	-3.5	12.811	80
804.1	8.0	17.9	0.7378	0.7066	0.0311	-2.7	12.670	77
782.4	9.0	17.0	0.7315	0.6934	0.0381	-2.4	12.083	78
759.8	10.0	15.0	0.7283	0.6801	0.0483	-2.2	10.842	75
733.8	11.0	13.0	0.7228	0.6615	0.0613	-2.0	9.680	76
707.5	12.0	11.1	0.7099	0.6456	0.0643	-1.6	8.273	70
682.6	13.0	9.6	0.7014	0.6289	0.0724	-1.4	6.627	60
660.7	14.0	8.2	0.6954	0.6186	0.0768	-1.8	6.051	59
640.7	15.0	6.8	0.6912	0.6074	0.0837	-2.3	6.121	62
621.2	16.0	5.1	0.6846	0.5930	0.0916	-3.1	5.959	67
597.3	17.0	3.4	0.6740	0.5692	0.1049	-4.3	4.939	62
574.1	18.0	0.5	0.6603	0.5307	0.1246	-6.4	4.390	59
557.2	19.0	-3.2	0.6420	0.4957	0.1463	-8.3	2.774	54
545.9	20.0	-7.5	0.6245	0.4497	0.1748	-9.4	1.928	47
533.4	21.0	-11.2	0.6118	0.4214	0.1905	-7.3	0.930	30
518.7	22.0	-14.8	0.6063	0.3994	0.2069	-3.7		M
504.1	23.0	-17.6	0.6069	0.3930	0.2129	-1.1		M
490.6	24.0	-19.4	0.6003	0.3922	0.2080	0.9	0.096	5
477.1	25.0	-21.7	0.5850	0.3822	0.2028	1.1	0.111	7
462.2	26.0	-22.5	0.5750	0.3736	0.2014	0.8	0.116	8
446.3	27.0	-24.5	0.5756	0.3727	0.2029	0.9	0.105	9
432.0	28.0	-26.7	0.5683	0.3706	0.1977	1.5	0.212	21
418.7	29.0	-28.0	0.5646	0.3705	0.1940	2.2	0.198	22
406.4	30.0	-29.6	0.5551	0.3669	0.1882	2.1	0.181	21
394.7	31.0	-31.4	0.5495	0.3651	0.1834	2.1	0.146	21
383.3	32.0	-33.5	0.5434	0.3625	0.1809	2.2	0.130	21
370.7	33.0	-35.3	0.5374	0.3613	0.1761	2.1	0.114	22
357.1	34.0	-37.2	0.5299	0.3607	0.1692	1.6	0.105	23
343.2	35.0	-38.8	0.5243	0.3588	0.1655	0.1	0.093	24
329.9	36.0	-40.5	0.5213	0.3534	0.1679	-2.8	0.093	27
316.8	37.0	-42.4	0.5209	0.3451	0.1758	-7.6	0.092	31
304.5	38.0	-44.8	0.5310	0.3351	0.1960	-12.4	0.082	34
292.3	39.0	-47.3	0.5549	0.3221	0.2328	-15.8	0.061	34
280.4	40.0	-49.5	0.5770	0.3064	0.2706	-15.2	0.052	34
269.0	41.0	-51.4	0.5923	0.2928	0.2995	-11.3		A
258.8	42.0	-53.0	0.5927	0.2830	0.3096	-6.5		A
249.1	43.0	-53.7	0.5937	0.2759	0.3178	-1.8		A
240.0	44.0	-53.7	0.5890	0.2721	0.3169	1.3		A
232.1	45.0	-54.5	0.5812	0.2714	0.3098	3.3		A
225.0	46.0	-55.3	0.5719	0.2678	0.3041	2.5		A
217.8	47.0	-55.2	0.5635	0.2610	0.3028	0.0		A
210.1	48.0	-61.1	0.5772	0.2725	0.3046	-2.0		A
201.8	49.0	-63.3	0.5823	0.2734	0.3094	-3.3		A
194.3	50.0	-61.1	0.5764	0.2624	0.3140	-4.9		A
187.7	51.0	-55.8	0.5624	0.2427	0.3197	-7.4		A
182.2	52.0	-57.4	0.5698	0.2413	0.3284	-11.0		A
176.9	53.0	-58.1	0.5775	0.2362	0.3413	-12.3		A
172.2	54.0	-58.2	0.5832	0.2286	0.3547	-10.1		A
166.6	55.0	-58.3	0.5853	0.2244	0.3610	-6.1		A
160.5	56.0	-58.5	0.5867	0.2218	0.3649	-3.3		A
153.3	57.0	-58.7	0.5863	0.2207	0.3661	-1.1		A

REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

1 FILTERED RADIONETER SOND E RUN FOR RND 6 JUN 1973 OPUS 6								
PRESS	TIME	T-AIR	F-UP	F-DN	F-NET	COOL	Q-MIX	R-HUM
(MB)	(MIN)	(DEG C)	(LY/MIN)	(LY/MIN)	(LY/MIN)	(DEG/DA)	(GM/KG)	(PC)
1016.7	0.0	22.3	0.6348	0.7241	-0.0892	0.0	15.106	91
990.5	1.0	20.0	0.5978	0.7229	-0.1251	8.1	13.296	69
964.1	2.0	17.8	0.5710	0.6959	-0.1249	1.8	10.090	71
937.7	3.0	15.4	0.5522	0.6779	-0.1258	0.4	7.984	72
909.9	4.0	13.4	0.5467	0.6756	-0.1289	0.9	8.404	75
882.6	5.0	13.1	0.5647	0.6970	-0.1323	1.7	8.635	78
856.7	6.0	12.0	0.5642	0.7110	-0.1428	2.4	8.264	83
830.9	7.0	11.4	0.5754	0.7323	-0.1569	2.7	7.940	76
804.0	8.0	11.0	0.5790	0.7494	-0.1705	2.3	8.441	82
777.1	9.0	9.7	0.5693	0.7474	-0.1781	1.9	8.532	88
751.0	10.0	8.2	0.5575	0.7417	-0.1842	1.5	8.725	95
725.9	11.0	6.8	0.5516	0.7433	-0.1917	1.8	8.564	100
702.4	12.0	5.5	0.5466	0.7459	-0.1993	1.6	7.653	95
679.1	13.0	4.5	0.5351	0.7437	-0.2086	1.0	6.219	80
657.1	14.0	2.4	0.5144	0.7220	-0.2076	0.5	4.680	64
634.7	15.0	0.4	0.4912	0.6987	-0.2074	1.0	1.587	27
614.3	16.0	-1.0	0.4780	0.6886	-0.2107	2.1	1.712	29
593.8	17.0	-1.8	0.4820	0.7079	-0.2220	2.8	1.727	30
576.0	18.0	-3.2	0.4768	0.7112	-0.2345	2.8	1.629	31
559.7	19.0	-4.3	0.4735	0.7143	-0.2408	2.3	1.551	31
544.6	20.0	-5.2	0.4709	0.7155	-0.2446	2.4	1.471	30
528.3	21.0	-5.9	0.4644	0.7170	-0.2526	2.5	1.400	30
511.9	22.0	-7.1	0.4569	0.7178	-0.2609	2.1	1.425	32
495.8	23.0	-8.6	0.4493	0.7164	-0.2671	1.3	1.286	32
480.3	24.0	-10.4	0.4425	0.7086	-0.2661	0.5	1.171	32
465.7	25.0	-12.1	0.4355	0.7022	-0.2667	0.6	0.969	30
453.9	26.0	-13.7	0.4309	0.6986	-0.2678	1.6	0.947	28
442.5	27.0	-15.3	0.4295	0.7024	-0.2729	2.2	0.757	29
430.8	28.0	-17.1	0.4236	0.7033	-0.2797	2.0	0.687	29
416.0	29.0	-18.7	0.4189	0.7021	-0.2832	1.4	0.609	29
400.9	30.0	-20.2	0.4131	0.6986	-0.2855	1.1	0.566	29
385.7	31.0	-21.5	0.4082	0.6955	-0.2873	1.0	0.498	28
372.0	32.0	-23.2	0.4042	0.6951	-0.2909	0.9	0.446	28
357.7	33.0	-24.9	0.4003	0.6932	-0.2929	0.7	0.389	28
344.7	34.0	-26.7	0.3971	0.6909	-0.2937	0.2	0.355	28
332.1	35.0	-28.8	0.3932	0.6873	-0.2941	-0.2	0.299	28
320.7	36.0	-30.9	0.3902	0.6823	-0.2921	-0.1	0.251	28
309.8	37.0	-32.7	0.3874	0.6794	-0.2919	0.2	0.232	28
299.7	38.0	-34.4	0.3837	0.6773	-0.2936	0.5	0.198	29
299.3	39.0	-36.5	0.3808	0.6756	-0.2948	0.7	0.167	28
279.0	40.0	-38.5	0.3798	0.6747	-0.2949	1.0	0.139	28
268.7	41.0	-40.4	0.3800	0.6774	-0.2974	1.7	0.121	28
258.5	42.0	-41.8	0.3750	0.6766	-0.3016	2.6	0.109	28
248.7	43.0	-43.2	0.3705	0.6770	-0.3065	3.5	0.097	28
239.0	44.0	-45.0	0.3661	0.6785	-0.3124	4.7	0.087	29
229.2	45.0	-46.5	0.3585	0.6798	-0.3213	5.2	0.076	30
219.9	46.0	-47.8	0.3482	0.6804	-0.3322	4.0	0.076	31
210.7	47.0	-49.1	0.3454	0.6842	-0.3387	1.0	0.065	31
202.5	48.0	-50.6	0.3562	0.6907	-0.3546	-1.6		A
195.7	49.0	-51.3	0.3704	0.6978	-0.3274	-3.0		A
190.1	50.0	-51.8	0.3786	0.7061	-0.3275	-3.3		A
183.8	51.0	-51.9	0.3823	0.7078	-0.3255	-4.1		A
177.1	52.0	-51.9	0.3879	0.7059	-0.3179	-5.0		A
169.9	53.0	-51.6	0.3922	0.7017	-0.3094	-4.4		A
163.3	54.0	-51.1	0.3946	0.7012	-0.3066	-2.5		A
156.6	55.0	-50.6	0.3930	0.6986	-0.3055	-1.4		A
150.4	56.0	-50.3	0.3909	0.6964	-0.3055	-2.1		A
144.8	57.0	-50.1	0.3907	0.6932	-0.3025	-3.3		A
140.0	58.0	-50.5	0.3941	0.6920	-0.2979	-4.9		A
135.0	59.0	-50.9	0.3973	0.6914	-0.2941	-5.4		A
130.0	60.0	-52.0	0.4008	0.6898	-0.2890	-5.0		A

125.0	61.0	-53.3	0.4026	0.6867	-0.2842	-3.5	A
120.0	62.0	-54.6	0.4052	0.6867	-0.2815	-1.7	A
114.9	63.0	-55.2	0.4092	0.6924	-0.2832	-0.5	A
110.2	64.0	-56.1	0.4125	0.6949	-0.2824	-0.3	A
106.0	65.0	-56.9	0.4128	0.6946	-0.2819	-1.3	A
101.7	66.0	-55.7	0.4123	0.6936	-0.2813	-2.1	A
97.3	67.0	-55.7	0.4144	0.6934	-0.2789	-3.5	A
93.8	68.0	-55.8	0.4171	0.6933	-0.2762	-4.6	A
90.9	69.0	-56.1	0.4210	0.6938	-0.2728	-7.0	A

1 FILTERED RADIOMETER SONDE RUN FOR RNJ 7 AUG 1973 OPUS 7								
PRESS (MM)	TIME (H)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-RET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
1013.9	0.0	29.5	1.1210	0.6136	0.5073	0.0	16.457	64
993.7	1.0	27.6	1.1368	0.6606	0.4763	9.1	15.527	66
972.3	2.0	25.6	1.1349	0.7093	0.4256	14.5	16.384	80
948.4	3.0	23.4	1.1318	0.7676	0.3643	16.1	19.446	100
926.4	4.0	21.5	1.1191	0.8278	0.2913	15.3	17.288	100
905.1	5.0	19.7	1.0940	0.8618	0.2322	10.0	14.212	87
882.5	6.0	18.0	1.0625	0.8544	0.2081	4.0	11.763	80
864.0	7.0	16.6	1.0554	0.8323	0.2181	-0.2	10.078	74
842.9	8.0	15.4	1.0582	0.8287	0.2295	0.7	9.847	74
818.8	9.0	14.1	1.0532	0.8290	0.2243	3.6	9.713	79
791.8	10.0	12.6	1.0212	0.8295	0.1918	4.6	8.916	77
770.6	11.0	11.2	0.9815	0.8169	0.1646	3.1	8.312	76
750.4	12.0	9.6	0.9620	0.7976	0.1645	-1.3	7.439	74
730.6	13.0	8.0	0.9530	0.7712	0.1818	-6.7	6.724	73
711.4	14.0	6.8	0.9525	0.7465	0.2060	-11.4	6.416	73
691.6	15.0	5.6	0.9692	0.7126	0.2566	-14.3	6.064	73
671.0	16.0	4.4	0.9927	0.6753	0.3174	-14.5	5.786	74
650.5	17.0	3.3	1.0127	0.6402	0.3725	-11.0	5.485	72
630.5	18.0	2.1	1.0330	0.6335	0.3965	-6.6	5.233	73
610.0	19.0	0.8	1.0531	0.6446	0.4085	-3.4	4.640	69
589.2	20.0	-0.8	1.0758	0.6613	0.4145	-2.6	4.156	67
570.2	21.0	-2.3	1.1034	0.6820	0.4214	-4.2	3.194	56
552.8	22.0	-3.2	1.1428	0.7095	0.4333	-8.4	2.489	46
535.9	23.0	-4.5	1.2048	0.7436	0.4642	-15.7	2.077	39
519.2	24.0	-6.6	1.2722	0.7550	0.5172	-23.0	2.446	55
503.0	25.0	-8.1	1.3584	0.7549	0.6036	-27.7	3.115	76
486.7	26.0	-8.8	1.4387	0.7530	0.6857	-28.7	3.453	82
470.3	27.0	-9.9	1.5171	0.7508	0.7663	-24.7	2.870	75
453.6	28.0	-11.6	1.5740	0.7410	0.8330	-18.8	2.299	66
437.4	29.0	-13.4	1.6394	0.7324	0.8770	-11.9	1.777	58
421.7	30.0	-15.3	1.6186	0.7275	0.8911	-6.4	1.788	65
407.2	31.0	-17.3	1.6160	0.7208	0.8972	-1.5	1.510	61
393.0	32.0	-19.1	1.6155	0.7104	0.9051	3.3	1.174	54
378.9	33.0	-20.8	1.5862	0.6983	0.8880	9.2	0.963	49
363.9	34.0	-22.8	1.5468	0.6918	0.8549	13.4	0.711	42
347.9	35.0	-25.1	1.5030	0.6953	0.8076	15.1	0.398	28
332.2	36.0	-27.7	1.4702	0.6989	0.7713	16.0	0.299	25
318.3	37.0	-30.5	1.4265	0.6945	0.7320	16.0	0.260	27
305.0	38.0	-33.1	1.3868	0.6926	0.6942	16.6	0.220	29
292.5	39.0	-35.5	1.3480	0.6900	0.6580	17.0	0.197	30

1 FILTERED RADIOMETER SENSOR RUN FOR RNB 7 AUG 1973 OPUS A									
PFSSS	TIME	T-AIR	F-UP	F-DN	F-NET	COOL	Q-MIX	R-HUM	
(ME)	(MIN)	(DEG C)	(LY/MIN)	(LY/MIN)	(LY/MIN)	(DEG/DA)	(GM/KG)	(PC)	
1013.8	3.0	29.8	0.6869	0.7204	-0.0336	0.0	14.346	55	
992.6	1.0	30.1	0.6803	0.6498	0.0105	-8.3	17.704	61	
955.6	2.0	29.1	0.6491	0.6359	0.0133	1.4	17.341	66	
933.0	3.0	26.8	0.6362	0.6211	0.0151	-1.0	17.719	73	
914.4	4.0	25.1	0.6272	0.6138	0.0135	-1.6	16.560	76	
897.0	5.0	23.5	0.6410	0.6130	0.0280	-2.3	13.389	65	
876.7	6.0	21.9	0.6369	0.6063	0.0326	-1.9	12.325	65	
853.7	7.0	20.3	0.6239	0.5857	0.0432	-1.3	11.324	64	
830.7	8.0	18.6	0.6156	0.5752	0.0404	-1.1	10.699	64	
809.8	9.0	17.8	0.6100	0.5619	0.0460	-0.7	9.720	64	
790.9	10.0	17.4	0.6034	0.5523	0.0510	-0.3	11.288	68	
772.0	11.0	17.1	0.5979	0.5472	0.0507	-0.1	10.825	69	
752.8	12.0	15.9	0.5900	0.5468	0.0432	-0.6	10.748	71	
734.1	13.0	15.1	0.5920	0.5379	0.0541	-1.6	10.408	71	
717.3	14.0	13.9	0.5904	0.5323	0.0581	-2.5	9.699	69	
702.7	15.0	12.4	0.5925	0.5262	0.0663	-2.0	8.531	66	
689.2	16.0	11.4	0.5837	0.5130	0.0707	-1.8	7.985	66	
674.9	17.0	10.5	0.5673	0.4941	0.0732	-1.3	8.727	71	
658.4	18.0	9.8	0.5536	0.4774	0.0762	-0.9	8.420	75	
640.6	19.0	8.1	0.5418	0.4615	0.0802	-0.7	9.555	86	
624.1	20.0	6.5	0.5429	0.4624	0.0805	-1.5	7.743	81	
610.0	21.0	4.4	0.5424	0.4618	0.0807	-2.2	6.460	73	
595.3	22.0	3.0	0.5568	0.4612	0.0956	-1.7	4.330	55	
581.0	23.0	1.7	0.5511	0.4512	0.0959	-1.0	3.824	51	
567.1	24.0	1.3	0.5391	0.4478	0.0913	-0.3	3.367	45	
554.6	25.0	1.0	0.5301	0.4353	0.0948	-1.0	3.414	45	
541.7	26.0	0.7	0.5271	0.4250	0.1021	-1.8	3.522	47	
528.9	27.0	0.5	0.5177	0.4127	0.1050	-1.3	4.892	65	
515.1	28.0	0.6	0.5055	0.4027	0.1068	-0.8	5.621	72	
500.8	29.0	0.5	0.4990	0.3923	0.1067	-1.6	4.697	58	
497.3	30.0	-0.0	0.4915	0.3811	0.1104	-3.2	3.882	49	
474.9	31.0	-1.3	0.4883	0.3664	0.1219	-4.0	2.932	39	
462.7	32.0	-2.9	0.4905	0.3557	0.1349	-3.7	4.147	62	
450.4	33.0	-4.1	0.4870	0.3494	0.1376	-2.9	4.141	66	
438.8	34.0	-4.7	0.4810	0.3407	0.1403	-2.5	4.118	66	
428.0	35.0	-5.2	0.4762	0.3278	0.1485	-2.5	3.843	63	
416.9	36.0	-5.9	0.4692	0.3154	0.1538	-2.2	3.539	60	
406.3	37.0	-6.9	0.4602	0.3058	0.1544	-2.6	3.337	58	
395.4	38.0	-7.9	0.4547	0.2968	0.1578	-3.9	2.610	49	
384.3	39.0	-9.0	0.4554	0.2850	0.1704	-5.7	2.118	42	
374.4	40.0	-10.3	0.4557	0.2736	0.1820	-5.6	1.651	35	
365.3	41.0	-11.8	0.4556	0.2641	0.1915	-3.6	2.083	49	
355.2	42.0	-13.4	0.4509	0.2558	0.1951	-2.3	1.980	51	
344.3	43.0	-14.5	0.4428	0.2484	0.1944	-2.6	1.150	32	
333.6	44.0	-15.7	0.4394	0.2386	0.2008	-3.9	1.496	43	
323.3	45.0	-17.0	0.4377	0.2253	0.2124	-5.0	1.203	39	
314.0	46.0	-18.3	0.4337	0.2133	0.2204	-4.8	1.046	36	
306.1	47.0	-19.2	0.4263	0.2011	0.2252	-4.1	0.938	34	
297.7	48.0	-20.0	0.4234	0.1997	0.2317	-3.6	0.606	23	
288.1	49.0	-21.0	0.4163	0.1799	0.2369	-3.9	0.350	14	
278.2	50.0	-22.0	0.4132	0.1709	0.2423	-4.2	0.323	14	
268.7	51.0	-22.9	0.4094	0.1589	0.2504	-4.8	0.366	13	
260.3	52.0	-23.7	0.4032	0.1450	0.2581	-4.6	0.300	13	
253.0	53.0	-24.8	0.3933	0.1335	0.2648	-1.9	0.294	15	
245.5	54.0	-26.2	0.3935	0.1270	0.2665	2.1	0.296	16	
237.6	55.0	-27.5	0.3817	0.1227	0.2590	4.9	0.260	15	
229.7	56.0	-29.2	0.3644	0.1165	0.2478	3.6	0.243	16	
221.8	57.0	-31.1	0.3467	0.1052	0.2416	-1.0	0.286	22	
213.1	58.0	-33.0	0.3421	0.0915	0.2506	-6.1	0.304	27	
205.3	59.0	-34.1	0.3451	0.0809	0.2643	-9.5	0.309	29	
198.7	60.0	-35.2	0.3509	0.0734	0.2775	-9.3			

A

192.1	61.7	-36.6	0.3584	0.0706	0.2678	-7.0	A
184.9	62.0	-38.9	0.3631	0.0695	0.2936	-5.4	A
178.2	63.0	-41.2	0.3626	0.0661	0.2965	-5.8	A
171.9	64.0	-43.5	0.3673	0.0626	0.3047	-8.0	A
166.1	65.0	-45.4	0.3801	0.0617	0.3144	-8.3	A
159.9	66.0	-47.2	0.3959	0.0631	0.3267	-5.2	A
152.9	67.0	-48.2	0.3905	0.0671	0.3294	-1.1	A
145.0	68.0	-48.9	0.3876	0.0609	0.3267	2.3	A
136.7	69.0	-49.3	0.3768	0.0557	0.3212	3.0	A
130.8	70.0	-50.1	0.3725	0.0567	0.3158	-0.8	A
127.6	71.0	-51.6	0.3805	0.0624	0.3180	-9.6	A
126.1	72.0	-52.8	0.3951	0.0637	0.3314	-16.8	A
123.9	73.0	-53.4	0.4012	0.0633	0.3378	-10.9	A
121.0	74.0	-53.4	0.3996	0.0623	0.3373	-5.3	A
116.8	75.0	-53.9	0.4030	0.0628	0.3402	-5.3	A
112.2	76.0	-54.3	0.4102	0.0643	0.3459	-7.4	A
108.1	77.0	-54.5	0.4160	0.0638	0.3521	-9.0	A
104.8	78.0	-54.5	0.4234	0.0664	0.3570	-9.6	A
102.3	79.0	-55.0	0.4345	0.0715	0.3630	-7.1	A
99.8	80.0	-55.4	0.4399	0.0750	0.3649	-7.6	A
97.0	81.0	-55.5	0.4405	0.0761	0.3645	-8.0	A
93.8	82.0	-55.4	0.4427	0.0685	0.3741	-7.4	A
90.6	83.0	-55.7	0.4435	0.0654	0.3781	-4.4	A
87.5	84.0	-56.0	0.4486	0.0709	0.3777	-0.9	A
84.3	85.0	-55.9	0.4529	0.0786	0.3744	-1.9	A
81.5	86.0	-55.5	0.4574	0.0791	0.3783	-5.0	A
79.2	87.0	-55.8	0.4591	0.0767	0.3823	-6.1	A
77.5	88.0	-56.5	0.4649	0.0805	0.3843	1.6	A
75.7	89.0	-57.0	0.4676	0.0852	0.3824	13.7	A
73.9	90.0	-56.9	0.4649	0.0891	0.3757	16.0	A
72.1	91.0	-56.8	0.4604	0.0949	0.3656	6.7	A
70.3	92.0	-56.7	0.4649	0.0967	0.3682	-8.4	A
68.4	93.0	-56.7	0.4730	0.0972	0.3757	-23.8	A

FILTERED RADIOMETER SOND E RUN FOR RNB 8 AUG 1973							OPUS 9	
PRESS	TIME	T-AIR	F-UP	F-ON	F-NET	COOL	Q-MIX	R-HUM
(MB)	(MIN)	(DEG C)	(LY/MIN)	(LY/MIN)	(LY/MIN)	(DEG/DA)	(GM/KG)	(PC)
1015.0	0.0	25.5	0.6486	0.6466	0.0020	0.0	19.001	92
981.2	1.0	25.4	0.7167	0.6153	0.0954	-15.7	18.665	88
950.3	2.0	24.3	0.7034	0.5939	0.1095	-4.3	17.440	87
923.2	3.0	22.3	0.6991	0.5774	0.1217	-2.0	15.127	81
896.0	4.0	20.0	0.6935	0.5625	0.1310	-1.0	13.770	84
867.6	5.0	17.4	0.6869	0.5545	0.1323	-0.0	11.037	75
840.3	6.0	15.7	0.6752	0.5476	0.1276	0.4	9.647	75
815.6	7.0	14.8	0.6652	0.5415	0.1238	-0.0	9.961	74
791.2	8.0	14.2	0.6552	0.5279	0.1274	-0.4	9.635	75
765.6	9.0	12.6	0.6519	0.5193	0.1326	-0.5	8.396	69
740.6	10.0	11.0	0.6456	0.5143	0.1313	-0.4	7.976	72
716.6	11.0	9.6	0.6393	0.5078	0.1315	-0.7	6.912	64
694.3	12.0	8.1	0.6304	0.4953	0.1352	-1.3	6.276	63
672.9	13.0	6.1	0.6149	0.4738	0.1451	-1.4	6.151	71
651.9	14.0	4.2	0.6070	0.4587	0.1483	-1.4	6.222	78
629.8	15.0	2.6	0.6013	0.4500	0.1514	-1.3	5.361	72
607.1	16.0	0.7	0.5964	0.4391	0.1573	-1.4	3.982	60
585.1	17.0	-1.2	0.5905	0.4264	0.1641	-1.2	3.149	52
565.3	18.0	-2.9	0.5814	0.4143	0.1671	-0.8	4.069	73
546.7	19.0	-4.5	0.5720	0.4047	0.1672	-0.6	2.112	42
527.7	20.0	-6.1	0.5645	0.3959	0.1686	-0.8	3.443	73
508.3	21.0	-7.5	0.5550	0.3825	0.1725	-1.4	3.964	93
490.1	22.0	-9.0	0.5461	0.3681	0.1780	-1.9	3.555	89
472.7	23.0	-10.8	0.5392	0.3530	0.1852	-1.7	3.434	94
455.3	24.0	-12.9	0.5323	0.3406	0.1917	-1.4	2.966	96
437.7	25.0	-15.1	0.5247	0.3338	0.1969	-1.7	2.507	90
421.5	26.0	-16.9	0.5195	0.3237	0.1957	-2.5	2.104	87
405.4	27.0	-18.4	0.5143	0.3073	0.2075	-3.3	1.338	84
389.3	28.0	-20.0	0.5094	0.2913	0.2181	-3.1	1.909	93
372.8	29.0	-21.9	0.5024	0.2768	0.2257	-2.7	1.581	90
357.2	30.0	-24.0	0.4947	0.2652	0.2295	-2.7	1.320	84
342.0	31.0	-25.9	0.4893	0.2517	0.2381	-3.1	1.042	76
326.9	32.0	-27.9	0.4838	0.2362	0.2476	-3.6	0.810	68
310.5	33.0	-29.9	0.4766	0.2189	0.2577	-3.9	0.650	62
294.9	34.0	-32.0	0.4688	0.2067	0.2682	-4.2	0.520	57
281.7	35.0	-34.0	0.4620	0.1835	0.2784	-4.5	0.382	50
269.6	36.0	-36.0	0.4551	0.1664	0.2867	-3.6	0.329	48
256.3	37.0	-37.5	0.4480	0.1497	0.2963	-0.9	0.287	48
243.1	38.0	-39.2	0.4323	0.1352	0.2970	2.7	0.271	50
231.0	39.0	-41.1	0.4046	0.1203	0.2844	6.1	0.256	56
218.7	40.0	-43.9	0.3706	0.1044	0.2662	8.0	0.224	60
206.1	41.0	-47.8	0.3419	0.0930	0.2489	9.2	0.165	66
194.1	42.0	-52.6	0.3242	0.0929	0.2313	10.0		A
184.3	43.0	-57.3	0.3124	0.1036	0.2088	10.5		A
175.2	44.0	-60.2	0.3056	0.1114	0.1942	9.5		A
167.3	45.0	-61.8	0.3013	0.1195	0.1817	9.3		A

1 FILTERED RADIOMETER SONDE RUN FOR RMB 8 AUG 1973 OPUS 10								
PRESS	TIME	T-AIR	F-UP	F-DN	F-NET	COOL	Q-MIX	R-HUM
(MM)	(MIN)	(DEG C)	(LY/MIN)	(LY/HIN)	(LY/MIN)	(DEG/DA)	(GM/KG)	(PC)
1016.4	0.0	29.1	0.6805	0.9045	-0.2240	0.1	23.310	89
985.1	1.0	26.4	0.8408	0.8761	-0.0353	-35.7	20.441	94
957.2	2.0	24.1	0.8355	0.8544	-0.0190	-3.0	17.654	88
933.8	3.0	22.8	0.8252	0.8342	-0.0090	-2.7	14.991	80
910.9	4.0	21.7	0.8201	0.8203	-0.0002	-2.1	13.993	78
885.3	5.0	20.3	0.8253	0.8151	0.0101	-1.4	12.513	72
859.2	6.0	18.8	0.8239	0.8081	0.0158	-0.6	11.825	76
832.8	7.0	17.2	0.8074	0.7952	0.0122	0.3	11.553	75
808.1	8.0	15.7	0.7906	0.7796	0.0109	0.2	8.862	65
783.2	9.0	13.7	0.7704	0.7635	0.0069	-0.1	8.506	67
759.4	10.0	11.9	0.7700	0.7551	0.0149	-0.2	8.148	70
734.6	11.0	10.0	0.7588	0.7463	0.0125	-0.6	7.614	72
710.3	12.0	8.1	0.7465	0.7340	0.0125	-1.1	7.446	77
687.1	13.0	6.6	0.7425	0.7213	0.0212	-1.5	6.730	76
664.7	14.0	4.9	0.7453	0.7124	0.0328	-1.8	6.628	78
642.3	15.0	3.4	0.7415	0.7088	0.0327	-1.6	6.457	87
619.7	16.0	1.9	0.7328	0.6915	0.0414	-1.7	6.692	92
597.0	17.0	0.6	0.7274	0.6894	0.0470	-2.1	6.244	92
575.3	18.0	-0.7	0.7268	0.6683	0.0588	-2.5	5.103	80
556.2	19.0	-2.1	0.7214	0.6589	0.0625	-3.1	4.587	77
538.6	20.0	-3.8	0.7200	0.6433	0.0767	-3.1	4.138	76
521.4	21.0	-5.1	0.7200	0.6320	0.0881	-2.4	3.593	73
503.3	22.0	-6.3	0.7237	0.6277	0.0931	-1.1	3.206	64
485.7	23.0	-6.9	0.7206	0.6247	0.0909	-0.7	2.206	47
468.8	24.0	-8.6	0.7205	0.6281	0.0924	-1.5	2.362	55
452.7	25.0	-10.5	0.7153	0.6173	0.0981	-2.9	2.099	55
436.2	26.0	-12.5	0.7120	0.6018	0.1103	-4.0	1.841	55
420.2	27.0	-14.6	0.7098	0.5883	0.1214	-3.7	1.556	52
404.7	28.0	-16.7	0.7143	0.5783	0.1359	-2.3	1.259	50
389.3	29.0	-18.8	0.7146	0.5797	0.1348	-0.9	0.788	35
372.1	30.0	-20.7	0.7131	0.5791	0.1340	-0.6	0.861	43
356.3	31.0	-22.6	0.7088	0.5738	0.1350	-2.0	0.697	39
342.2	32.0	-24.7	0.7089	0.5647	0.1442	-4.0	0.532	35
330.3	33.0	-26.7	0.7105	0.5559	0.1546	-5.3	0.445	34
318.1	34.0	-28.9	0.7103	0.5490	0.1703	-3.8	0.373	33
305.5	35.0	-31.2	0.7067	0.5297	0.1770	-3.1	0.277	30
292.3	36.0	-33.4	0.7038	0.5305	0.1734	-3.0	0.236	30
280.3	37.0	-35.8	0.7067	0.5200	0.1867	-2.4	0.199	30
269.7	38.0	-38.3	0.7074	0.5111	0.1963	-0.5	0.159	31
258.8	39.0	-40.9	0.7065	0.5177	0.1898	2.5	0.127	30
247.3	40.0	-43.3	0.7050	0.5275	0.1775	3.6	0.102	30
235.8	41.0	-46.1	0.7083	0.5359	0.1724	2.1	0.085	31
225.0	42.0	-48.6	0.7131	0.5435	0.1696	-1.9	0.065	32
215.3	43.0	-50.9	0.7153	0.5429	0.1735	-7.7		A
206.9	44.0	-52.9	0.7199	0.5270	0.1930	-10.3		A
198.9	45.0	-54.0	0.7229	0.5017	0.2212	-8.2		A
189.7	46.0	-55.4	0.7240	0.5027	0.2213	-4.3		A
180.3	47.0	-57.5	0.7223	0.5124	0.2159	-3.4		A
172.2	48.0	-59.8	0.7232	0.4970	0.2261	-5.1		A
164.3	49.0	-60.8	0.7326	0.4889	0.2437	-7.3		A
156.8	50.0	-62.3	0.7370	0.4913	0.2456	-4.2		A
149.5	51.0	-64.4	0.7439	0.4863	0.2576	1.0		A
143.3	52.0	-66.5	0.7451	0.4999	0.2453	11.8		A
136.7	53.0	-68.3	0.7416	0.5037	0.2379	13.4		A
129.7	54.0	-69.7	0.7347	0.5443	0.1905	7.9		A
124.2	55.0	-69.5	0.7343	0.5254	0.2089	0.1		A
118.2	56.0	-68.0	0.7384	0.5188	0.2196	-9.7		A
112.2	57.0	-65.9	0.7391	0.5164	0.2227	-6.4		A
99.2	59.0	-64.5	0.7504	0.5164	0.2340	-8.3		A
94.4	60.0	-64.7	0.7560	0.5115	0.2444	-10.7		A
90.3	61.0	-66.0	0.7646	0.5117	0.2529	-11.5		A
87.0	62.0	-66.5	0.7661	0.5071	0.2590	-10.6		A
84.5	63.0	-66.6	0.7636	0.4998	0.2638	-11.1		A

1 FILTERED RADIOMETER SONDE RUN FOR RNR 8 AUG 1973 OPUS 11								
PRESS (MM)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (G/KG)	R-HUM (PC)
1014.7	0.0	33.1	0.7173	0.7011	0.0162	0.0	23.590	83
949.3	1.0	25.0	0.8031	0.7214	0.0817	-15.0	14.524	76
963.1	2.0	21.0	0.7816	0.7179	0.0637	1.7	14.084	86
937.3	3.0	19.4	0.7674	0.7178	0.0496	0.9	13.305	86
910.8	4.0	17.7	0.7675	0.7163	0.0512	-2.1	10.712	77
886.6	5.0	16.2	0.7699	0.7005	0.0693	-4.1	9.704	75
863.3	6.0	15.2	0.7785	0.6796	0.0988	-3.8	9.737	76
840.3	7.0	14.2	0.7840	0.6742	0.1097	-1.8	8.031	67
817.3	8.0	12.9	0.7833	0.6771	0.1062	-0.1	8.085	70
794.5	9.0	11.6	0.7749	0.6738	0.1011	0.0	7.643	70
771.3	10.0	10.1	0.7638	0.6579	0.1059	-0.3	7.195	71
748.0	11.0	8.6	0.7595	0.6501	0.1094	-0.4	6.719	71
726.1	12.0	7.2	0.7569	0.6422	0.1088	-0.0	6.596	74
704.7	13.0	5.8	0.7495	0.6425	0.1069	0.3	6.021	73
684.3	14.0	4.7	0.7414	0.6335	0.1078	0.6	5.772	74
664.8	15.0	3.3	0.7364	0.6311	0.1053	0.4	5.940	79
646.3	16.0	2.0	0.7279	0.6290	0.0989	0.0	5.369	80
626.5	17.0	0.7	0.7227	0.6185	0.1041	-0.6	5.426	82
605.0	18.0	-0.4	0.7176	0.6096	0.1080	-0.7	5.256	85
583.3	19.0	-1.9	0.7167	0.6053	0.1114	-0.4	4.401	76
564.2	20.0	-3.3	0.7092	0.6020	0.1072	-0.4	3.845	72
548.2	21.0	-4.7	0.7056	0.5949	0.1107	-1.0	3.510	72
532.3	22.0	-5.6	0.7006	0.5855	0.1151	-1.4	3.260	68
515.5	23.0	-6.4	0.6978	0.5760	0.1218	-1.0	2.876	61
497.6	24.0	-7.6	0.6926	0.5711	0.1216	-0.7	2.553	58
480.5	25.0	-9.3	0.6883	0.5669	0.1214	-0.7	2.143	54
463.7	26.0	-10.9	0.6864	0.5606	0.1257	-1.0	1.768	49
447.0	27.0	-12.6	0.6845	0.5549	0.1298	-1.1	1.737	53
429.7	28.0	-14.5	0.6836	0.5522	0.1313	-1.5	1.680	57
415.1	29.0	-16.1	0.6811	0.5471	0.1340	-2.4	1.413	54
403.2	30.0	-17.7	0.6791	0.5363	0.1429	-2.9	0.987	41
392.4	31.0	-19.2	0.6774	0.5261	0.1513	-1.9	0.983	46
378.2	32.0	-20.6	0.6748	0.5219	0.1529	-0.8	0.778	39
361.0	33.0	-22.3	0.6689	0.5190	0.1499	-0.6	0.623	35
343.6	34.0	-24.5	0.6681	0.5138	0.1543	-1.4	0.523	34
330.3	35.0	-26.4	0.6674	0.5038	0.1585	-3.2	0.442	33
319.2	36.0	-28.3	0.6646	0.4984	0.1663	-4.0	0.318	26
307.1	37.0	-30.2	0.6662	0.4870	0.1792	-3.6	0.259	26
294.1	38.0	-32.5	0.6725	0.4878	0.1846	-2.8	0.225	26
283.5	39.0	-34.8	0.6796	0.4940	0.1856	-2.2	0.170	24
274.7	40.0	-36.8	0.6805	0.4902	0.1903	-2.4	0.148	25
264.5	41.0	-39.3	0.6818	0.4859	0.1959	-3.4	0.134	26
252.3	42.0	-41.7	0.6904	0.4899	0.2005	-4.9	0.100	27
240.3	43.0	-43.9	0.7085	0.4964	0.2122	-7.1	0.088	25
229.7	44.0	-45.7	0.7273	0.4969	0.2304	-8.5	0.067	24
220.1	45.0	-47.5	0.7388	0.4900	0.2487	-9.3	0.055	24
211.3	46.0	-49.6	0.7391	0.4832	0.2558	-9.1	0.055	26
202.6	47.0	-51.7	0.7500	0.4773	0.2727	-9.6		A
193.1	48.0	-53.5	0.7601	0.4774	0.2887	-11.5		A
183.1	49.0	-54.9	0.7857	0.4779	0.3078	-13.0		A
174.0	50.0	-56.8	0.8046	0.4784	0.3302	-15.4		A
166.2	51.0	-58.6	0.8357	0.4814	0.3543	-17.7		A
158.7	52.0	-59.7	0.8577	0.4810	0.3767	-18.8		A
150.9	53.0	-61.0	0.8813	0.4777	0.4036	-20.5		A
143.4	54.0	-62.7	0.9069	0.4779	0.4290	-21.1		A
136.6	55.0	-64.3	0.9398	0.4824	0.4573	-18.8		A
130.2	56.0	-64.6	0.9653	0.4863	0.4790	-14.1		A
124.3	57.0	-63.9	0.9722	0.4866	0.4855	-7.9		A
118.5	58.0	-62.5	0.9750	0.4867	0.4883	-5.8		A
112.3	59.0	-61.4	0.9791	0.4856	0.4935	-4.7		A
105.9	60.0	-60.8	0.9853	0.4806	0.5047	-2.3		A

99.8	61.0	-60.9	0.9816	0.4799	0.5018	1.7	A
94.4	62.0	-61.6	0.9818	0.4856	0.4961	5.8	A
89.7	63.0	-61.6	0.9785	0.4890	0.4895	7.6	A
84.8	64.0	-60.3	0.9699	0.4846	0.4853	11.1	A
80.7	65.0	-58.3	0.9550	0.4794	0.4756	15.0	A
77.4	66.0	-56.7	0.9394	0.4761	0.4633	18.1	A
74.3	67.0	-56.5	0.9280	0.4773	0.4507	16.2	A
69.8	68.0	-56.7	0.9262	0.4840	0.4422	14.0	A
64.9	69.0	-57.0	0.9216	0.4879	0.4336	16.4	A
60.3	70.0	-56.6	0.9052	0.4869	0.4183	19.0	A
56.8	71.0	-56.1	0.8911	0.4896	0.4015	20.4	A
54.0	72.0	-56.0	0.8863	0.4928	0.3935	20.5	A
50.9	73.0	-53.9	0.8828	0.4956	0.3871	22.1	A
48.3	74.0	-53.1	0.8676	0.4944	0.3732	28.0	A
45.7	75.0	-52.4	0.8514	0.4924	0.3589	27.0	A
42.9	76.0	-51.5	0.8402	0.4970	0.3432	18.9	A
40.4	77.0	-50.3	0.8437	0.5005	0.3402	4.8	A
38.6	78.0	-49.1	0.8364	0.4923	0.3441	-1.9	A
37.3	79.0	-47.7	0.8269	0.4773	0.3496	15.2	A
35.7	80.0	-47.0	0.8143	0.4729	0.3413	38.6	A
34.1	81.0	-46.3	0.8007	0.4785	0.3222	49.0	A
31.9	82.0	-45.4	0.7947	0.4926	0.3021	43.7	A
30.3	83.0	-44.4	0.7913	0.4970	0.2943	31.6	A
28.7	84.0	-43.5	0.7913	0.5030	0.2883	20.9	A
27.3	85.0	-42.3	0.7914	0.5079	0.2835	15.1	A
25.6	86.0	-40.9	0.7902	0.5093	0.2809	13.2	A
24.5	87.0	-39.7	0.7856	0.5068	0.2787	12.9	A
23.7	88.0	-38.5	0.7785	0.5024	0.2761	15.5	A
23.1	89.0	-37.4	0.7710	0.4962	0.2749	17.1	A
22.1	90.0	-36.7	0.7636	0.4926	0.2710	10.6	A
20.7	91.0	-36.3	0.7628	0.4931	0.2697	9.5	A
19.3	92.0	-35.8	0.7670	0.4991	0.2679	7.2	A
17.8	93.0	-35.4	0.7696	0.5037	0.2659	7.5	A
16.1	94.0	-34.9	0.7730	0.5092	0.2637	7.4	A

REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

1 FILTERED RADIOMETER SONDE RUN FOR RN3 8 AUG 1973 OPUS 12								
PRESS	TIME	T-AIR	F-UP	F-DN	F-NET	COOL	Q-MIX	R-HUM
(MB)	(MIN)	(DEG C)	(LY/MIN)	(LY/MIN)	(LY/MIN)	(DEG/DA)	(GM/KG)	(PC)
1013.1	0.0	31.5	0.7024	0.6904	0.0120	0.0	22.381	89
990.6	1.0	27.6	0.8470	0.6489	0.1981	-48.6	17.194	72
964.9	2.0	25.6	0.8343	0.6371	0.1972	-0.9	15.755	73
937.2	3.0	23.1	0.8187	0.6275	0.1912	1.2	14.364	76
904.5	4.0	20.8	0.8045	0.6240	0.1805	1.0	15.056	87
875.1	5.0	19.3	0.7946	0.6180	0.1766	0.4	14.712	92
849.5	6.0	17.6	0.7874	0.6094	0.1780	-0.3	11.695	76
822.9	7.0	15.6	0.7803	0.5964	0.1838	-0.8	10.976	81
795.3	8.0	13.7	0.7811	0.5968	0.1843	-0.7	11.501	94
767.7	9.0	12.4	0.7824	0.5915	0.1909	-0.1	11.059	92
740.0	10.0	11.1	0.7778	0.5867	0.1911	0.8	9.282	83
713.3	11.0	9.2	0.7656	0.5838	0.1818	1.8	8.658	84
689.0	12.0	7.2	0.7635	0.5938	0.1696	1.8	7.754	83
667.0	13.0	5.4	0.7692	0.6058	0.1634	0.1	6.909	83
645.9	14.0	4.1	0.7814	0.6170	0.1645	-3.7	6.783	84
625.1	15.0	2.9	0.8023	0.6203	0.1821	-8.1	7.006	92
605.3	16.0	1.4	0.8370	0.6108	0.2262	-10.6	6.190	89
585.5	17.0	0.2	0.8678	0.5959	0.2720	-10.5	4.745	71
565.3	18.0	-1.2	0.8844	0.5841	0.3002	-8.0	4.510	72
545.2	19.0	-2.6	0.8958	0.5727	0.3232	-1.5	4.297	75
525.7	20.0	-3.9	0.9095	0.5743	0.3351	8.4	4.050	72
506.1	21.0	-5.4	0.9084	0.6279	0.2805	18.2	3.608	72
487.3	22.0	-7.4	0.8945	0.7123	0.1822	20.2	3.006	65
469.7	23.0	-9.0	0.8826	0.7757	0.1069	12.5	2.476	61
453.0	24.0	-10.7	0.8828	0.7740	0.1068	1.1	1.994	52
437.3	25.0	-12.5	0.8933	0.7583	0.1350	-5.7	1.789	54
422.7	26.0	-14.5	0.9081	0.7544	0.1536	-4.0	1.595	54
408.2	27.0	-16.5	0.9250	0.7664	0.1586	0.4	1.412	53
392.9	28.0	-18.3	0.9341	0.7864	0.1477	2.6	1.122	50
376.9	29.0	-20.3	0.9365	0.8032	0.1333	-0.8	0.937	45
360.1	30.0	-22.2	0.9328	0.8007	0.1322	-11.1	0.656	37
342.7	31.0	-24.8	0.9180	0.7413	0.1767	-25.6	0.428	28
326.3	32.0	-27.4	0.9139	0.6293	0.2846	-37.1	0.422	34
312.1	33.0	-29.7	0.9172	0.5031	0.4140	-37.7	0.313	30
299.8	34.0	-32.1	0.9247	0.4342	0.4905	-26.8	0.214	24
289.0	35.0	-34.7	0.9163	0.4064	0.5099	-12.6	0.228	32
275.7	36.0	-37.2	0.9102	0.3910	0.5192	-6.1	0.231	40
264.7	37.0	-39.2	0.9046	0.3782	0.5284	-8.1	0.218	44
255.7	38.0	-41.0	0.9049	0.3652	0.5397	-14.0	0.199	47
247.9	39.0	-42.7	0.9254	0.3568	0.5686	-23.8	0.183	50
239.2	40.0	-44.9	0.9664	0.3598	0.6065	-33.6	0.153	51
228.4	41.0	-47.6	1.0447	0.3733	0.6714	-46.0	0.117	50
216.6	42.0	-50.8	1.1656	0.3946	0.7710	-57.4		A
204.7	43.0	-53.5	1.3232	0.4153	0.9129	-59.5		A
194.3	44.0	-56.0	1.4754	0.4330	1.0425	-41.5		A
184.7	45.0	-58.6	1.5503	0.4584	1.0919	-5.2		A
176.0	46.0	-60.6	1.5261	0.4918	1.0343	25.3		A
168.3	47.0	-61.8	1.4795	0.5226	0.9576	31.0		A
161.7	48.0	-62.8	1.4769	0.5417	0.9352	15.9		A
155.1	49.0	-64.9	1.5001	0.5536	0.9465	4.8		A
147.9	50.0	-66.5	1.5580	0.5611	0.9468	5.0		A
141.3	51.0	-67.3	1.4859	0.5619	0.9240	8.1		A
134.5	52.0	-67.7	1.4780	0.5606	0.9175	5.4		A
127.2	53.0	-67.7	1.4739	0.5601	0.9138	1.0		A
120.3	54.0	-67.6	1.4780	0.5584	0.9196	2.5		A
114.9	55.0	-67.6	1.4767	0.5593	0.9174	9.7		A
109.8	56.0	-67.9	1.4615	0.5597	0.9018	16.7		A
104.0	57.0	-68.0	1.4399	0.5632	0.8707	13.9		A
98.2	58.0	-67.8	1.4251	0.5632	0.8619	8.0		A
93.2	59.0	-67.4	1.4322	0.5603	0.8719	4.3		A
89.0	60.0	-66.0	1.4228	0.5545	0.8682	5.2		A

84.9	61.0	-63.6	1.4060	0.5496	0.8563	5.8	A
80.7	62.0	-61.3	1.3972	0.5464	0.8504	0.8	A
76.3	63.0	-60.8	1.4023	0.5426	0.8597	2.2	A
71.8	64.0	-61.3	1.3998	0.5360	0.8638	12.3	A
67.7	65.0	-62.3	1.3789	0.5353	0.8416	30.6	A
64.0	66.0	-63.2	1.3955	0.5396	0.8159	42.7	A
60.6	67.0	-62.8	1.3241	0.5424	0.7816	43.1	A
57.2	68.0	-61.2	1.3013	0.5391	0.7622	30.1	A
54.0	69.0	-59.5	1.2794	0.5358	0.7437	5.9	A
50.8	70.0	-58.4	1.2864	0.5300	0.7504	-14.5	A
47.6	71.0	-57.4	1.2980	0.5266	0.7714	-24.0	A
44.7	72.0	-56.2	1.3067	0.5193	0.7874	-11.2	A
42.4	73.0	-55.3	1.2951	0.5099	0.7852	17.6	A
40.2	74.0	-55.1	1.2755	0.5071	0.7684	49.2	A
38.1	75.0	-55.0	1.2563	0.5110	0.7453	63.8	A
35.9	76.0	-53.5	1.2292	0.5122	0.7170	64.5	A
33.9	77.0	-51.2	1.2040	0.5169	0.6931	47.5	A
32.1	78.0	-49.3	1.1911	0.5091	0.6820	21.9	A
30.4	79.0	-48.5	1.1947	0.5087	0.6860	6.8	A
28.7	80.0	-48.5	1.1893	0.5021	0.6872	12.9	A
27.0	81.0	-48.2	1.1778	0.4970	0.6808	32.1	A
25.4	82.0	-47.7	1.1635	0.4973	0.6662	46.9	A
23.9	83.0	-47.4	1.1525	0.5003	0.6522	46.6	A
22.5	84.0	-47.5	1.1423	0.5025	0.6397	34.4	A
21.2	85.0	-46.2	1.1363	0.5000	0.6363	31.2	A
20.0	86.0	-44.3	1.1317	0.4976	0.6341	28.8	A
17.6	88.0	-42.4	1.1116	0.4984	0.6133	24.0	A
16.2	89.0	-42.7	1.1054	0.4991	0.6063	3.0	A
14.7	90.0	-42.7	1.1030	0.4937	0.6093	-12.0	A
13.1	91.0	-42.8	1.1034	0.4855	0.6179	-31.5	A

1 FILTERED RADIOMETER SONDE RUN FOR RND 9 AUG 1973 OPUS 13

PRESS (MB)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)
1016.5	0.0	31.5	0.7024	0.8013	-0.0989	0.0	23.160	90
992.1	1.0	24.9	0.8103	0.8129	-0.0026	-16.5	18.283	91
950.5	2.0	21.8	0.8269	0.7952	0.0117	-0.3	14.742	85
922.3	3.0	20.3	0.7931	0.7810	0.0121	-0.5	12.259	75
894.4	4.0	19.0	0.7818	0.7739	0.0079	0.0	8.839	56
867.7	5.0	17.1	0.7852	0.7733	0.0120	0.2	8.646	61
841.4	6.0	15.2	0.7830	0.7714	0.0115	0.2	7.861	62
816.3	7.0	13.5	0.7764	0.7702	0.0061	-0.2	6.844	56
792.0	8.0	12.2	0.7710	0.7635	0.0075	-1.5	6.241	55
769.0	9.0	10.7	0.7633	0.7459	0.0174	-3.5	6.046	57
745.7	10.0	9.2	0.7516	0.7159	0.0357	-4.9	5.236	54
722.5	11.0	7.3	0.7417	0.6797	0.0620	-5.1	5.636	63
699.7	12.0	5.3	0.7336	0.6512	0.0824	-4.3	5.417	67
677.0	13.0	3.3	0.7260	0.6329	0.0932	-3.3	5.058	71
654.0	14.0	1.5	0.7178	0.6142	0.1036	-2.3	5.277	80
632.3	15.0	-0.2	0.7113	0.5967	0.1147	-1.3	4.786	79
611.6	16.0	-1.8	0.7005	0.5865	0.1140	0.3	4.666	85
591.1	17.0	-3.2	0.6915	0.5868	0.1107	1.7	4.174	81
571.2	18.0	-4.0	0.6809	0.5808	0.1000	2.0	3.681	75
553.2	19.0	-6.1	0.6764	0.5834	0.0930	1.7	3.214	73
535.6	20.0	-7.6	0.6753	0.5842	0.0911	1.3	3.175	78
517.1	21.0	-8.8	0.6773	0.5844	0.0889	1.0	3.099	81
498.2	22.0	-10.3	0.6795	0.5978	0.0817	-0.2	2.602	72
479.8	23.0	-12.2	0.6813	0.5978	0.0825	-2.1	2.211	71
462.2	24.0	-14.2	0.6845	0.5967	0.0878	-3.5	1.867	67
444.8	25.0	-15.9	0.6858	0.5736	0.1123	-3.4	1.638	65
428.2	26.0	-17.7	0.6817	0.5614	0.1203	-1.8	1.408	62
411.9	27.0	-19.6	0.6766	0.5567	0.1199	-0.9	1.164	58
396.0	28.0	-21.7	0.6755	0.5561	0.1193	-1.1	1.055	61
379.8	29.0	-23.9	0.6786	0.5540	0.1246	-2.3	0.908	61
364.4	30.0	-26.1	0.6805	0.5470	0.1335	-4.0	0.706	56
349.5	31.0	-28.3	0.6814	0.5385	0.1434	-5.7	0.534	50
335.4	32.0	-30.4	0.6893	0.5272	0.1620	-7.4	0.411	44
321.7	33.0	-32.5	0.6980	0.5174	0.1806	-8.0	0.335	43
309.2	34.0	-34.8	0.7053	0.5035	0.2018	-8.4	0.287	43
296.8	35.0	-37.0	0.7096	0.4963	0.2133	-8.4	0.222	41
285.3	36.0	-39.0	0.7174	0.4823	0.2351	-7.9	0.096	21
273.5	37.0	-41.3	0.7264	0.4771	0.2493	-6.7	0.066	17
261.3	38.0	-43.7	0.7372	0.4742	0.2630	-4.6	0.063	21
248.9	39.0	-46.3	0.7445	0.4767	0.2678	-2.9	0.044	17
236.9	40.0	-48.9	0.7476	0.4747	0.2728	-1.7	0.032	17
225.2	41.0	-51.7	0.7482	0.4722	0.2740	-1.3		A
213.8	42.0	-54.3	0.7428	0.4655	0.2773	-0.2		A
203.0	43.0	-56.8	0.7419	0.4632	0.2787	1.3		A
193.3	44.0	-58.8	0.7387	0.4665	0.2721	3.2		A
184.6	45.0	-60.3	0.7357	0.4699	0.2658	3.2		A
176.3	46.0	-61.9	0.7328	0.4747	0.2582	1.4		A
167.9	47.0	-63.9	0.7381	0.4763	0.2618	-1.5		A
160.1	48.0	-65.0	0.7443	0.4803	0.2646	-4.6		A
151.6	49.0	-65.4	0.7615	0.4882	0.2733	-6.3		A
143.7	50.0	-65.8	0.7760	0.4913	0.2847	-7.7		A
136.6	51.0	-66.8	0.7842	0.4902	0.2941	-8.9		A
130.0	52.0	-67.9	0.7904	0.4869	0.3035	-10.8		A
123.3	53.0	-68.7	0.7973	0.4794	0.3179	-10.9		A
116.7	54.0	-69.0	0.8072	0.4735	0.3336	-8.7		A
110.2	55.0	-68.3	0.8118	0.4705	0.3413	-3.1		A
104.0	56.0	-67.4	0.8162	0.4761	0.3481	2.9		A
99.0	57.0	-66.8	0.8185	0.4879	0.3306	6.4		A
94.5	58.0	-67.7	0.8257	0.5003	0.3253	5.5		A
90.0	59.0	-68.8	0.8317	0.5101	0.3216	3.9		A
85.3	60.0	-68.6	0.8342	0.5113	0.3229	4.6		A

80.9	61.0	-66.3	0.8270	0.5133	0.3167	6.6	A
76.8	62.0	-64.4	0.8216	0.5112	0.3105	9.0	A
73.0	63.0	-64.0	0.8195	0.5109	0.3038	8.0	A
68.9	64.0	-64.3	0.8162	0.5100	0.2902	6.9	A
63.9	65.0	-64.4	0.8100	0.5152	0.2948	6.4	A
58.4	66.0	-64.0	0.8067	0.5194	0.2874	6.5	A
52.0	67.0	-63.2	0.8023	0.5212	0.2811	7.1	A
45.8	68.0	-62.1	0.7960	0.5233	0.2725	9.6	A
40.8	69.0	-61.4	0.7916	0.5250	0.2666	12.7	A
37.8	70.0	-60.6	0.7815	0.5291	0.2524	15.8	A
35.0	71.0	-59.6	0.7706	0.5252	0.2454	15.0	A
32.2	72.0	-58.0	0.7600	0.5199	0.2401	10.7	A
29.5	73.0	-56.2	0.7541	0.5172	0.2363	12.0	A
27.2	74.0	-54.6	0.7492	0.5173	0.2319	16.7	A
24.9	75.0	-52.8	0.7424	0.5184	0.2240	24.0	A
22.8	76.0	-51.4	0.7414	0.5279	0.2135	28.1	A
20.6	77.0	-50.1	0.7430	0.5425	0.2006	35.8	A

1 FILTERED RADIOMETER SOND FOR AUG 9 AUG 1973 OPUS 14								
PRESS	TIME	T-AIR	F-UP	F-DN	F-NET	COOL	Q-MIX	R-HUM
(MB)	(MIN)	(DEG C)	(LY/MIN)	(LY/MIN)	(LY/MIN)	(DEG/DA)	(GM/KG)	(PC)
1013.7	0.0	25.3	0.6747	0.6851	-0.0104	0.0	10.629	53
993.6	1.0	23.2	0.6834	0.6651	0.0183	-8.4	14.473	79
973.7	2.0	21.8	0.6771	0.6690	0.0082	-0.7	14.601	86
954.3	3.0	21.0	0.6772	0.6717	0.0055	0.9	13.004	80
933.6	4.0	20.6	0.6751	0.6679	0.0073	1.2	9.891	59
912.3	5.0	19.8	0.6669	0.6631	0.0039	2.1	10.105	63
891.0	6.0	18.0	0.6446	0.6563	-0.0117	2.5	9.452	64
871.2	7.0	16.5	0.6337	0.6554	-0.0217	2.1	8.688	65
851.6	8.0	15.3	0.6224	0.6461	-0.0238	1.2	8.161	62
832.3	9.0	14.2	0.6150	0.6400	-0.0250	1.0	8.705	71
814.2	10.0	12.7	0.6069	0.6360	-0.0291	1.4	7.488	66
797.9	11.0	11.5	0.5996	0.6344	-0.0348	1.8	7.189	67
781.7	12.0	10.4	0.5911	0.6311	-0.0400	1.9	6.807	67
765.2	13.0	9.3	0.5825	0.6276	-0.0451	1.7	6.302	66
749.2	14.0	8.2	0.5747	0.6243	-0.0496	1.1	5.498	60
733.7	15.0	6.9	0.5677	0.6206	-0.0529	0.5	5.215	61
718.2	16.0	5.7	0.5644	0.6153	-0.0509	0.2	5.852	73
703.1	17.0	4.9	0.5591	0.6103	-0.0512	0.3	5.552	71
688.9	18.0	4.2	0.5542	0.6073	-0.0531	0.5	5.164	68
675.0	19.0	3.2	0.5487	0.6047	-0.0560	0.2	4.733	66
661.0	20.0	2.0	0.5449	0.5992	-0.0542	0.0	4.441	66
646.9	21.0	0.9	0.5420	0.5949	-0.0529	0.3	4.130	65
633.2	22.0	-0.3	0.5365	0.5917	-0.0552	1.1	3.850	65
619.9	23.0	-1.3	0.5287	0.5873	-0.0586	1.6	3.643	65
606.9	24.0	-2.3	0.5166	0.5803	-0.0637	1.8	3.590	67
594.2	25.0	-3.2	0.5052	0.5715	-0.0663	1.7	3.635	71
582.0	26.0	-4.2	0.4947	0.5657	-0.0710	1.6	3.137	65
569.8	27.0	-5.3	0.4896	0.5622	-0.0727	1.8	2.760	61
557.1	28.0	-6.2	0.4845	0.5569	-0.0774	1.4	2.802	65
544.1	29.0	-6.8	0.4798	0.5516	-0.0818	1.0	2.970	69
530.5	30.0	-7.5	0.4773	0.5599	-0.0821	0.4	2.401	58
517.9	31.0	-8.6	0.4763	0.5573	-0.0810	0.8	2.222	57
506.6	32.0	-9.9	0.4710	0.5533	-0.0823	1.7	2.265	63
495.9	33.0	-11.0	0.4603	0.5498	-0.0895	2.3	1.820	54
483.9	34.0	-12.2	0.4524	0.5469	-0.0944	2.3	1.695	54
472.3	35.0	-13.5	0.4449	0.5422	-0.0973	1.5	1.454	51
461.8	36.0	-14.8	0.4367	0.5378	-0.1010	0.9	1.319	50
452.0	37.0	-16.3	0.4311	0.5317	-0.1005	0.0	1.227	51
441.8	38.0	-18.0	0.4292	0.5289	-0.0997	-0.6	1.084	51
432.3	39.0	-19.6	0.4288	0.5271	-0.0993	-0.8	0.956	50
424.0	40.0	-21.0	0.4294	0.5263	-0.0969	-0.8	0.788	46
417.0	41.0	-22.4	0.4275	0.5231	-0.0956	0.6	0.621	40
409.8	42.0	-23.7	0.4212	0.5172	-0.0960	2.6	0.457	33
402.1	43.0	-24.8	0.4111	0.5138	-0.1027	3.9	0.398	31
394.0	44.0	-25.7	0.4004	0.5105	-0.1101	3.9	0.379	31
386.0	45.0	-26.5	0.3914	0.5058	-0.1144	3.4	0.356	31
378.0	46.0	-27.4	0.3844	0.5009	-0.1165	3.7	0.338	31
370.0	47.0	-28.2	0.3764	0.4992	-0.1228	4.6	0.321	31
362.0	48.0	-29.0	0.3684	0.4991	-0.1307	5.8	0.302	31

1 FILTERED RADIOMETER SONDE RUN FOR WSL 11 AUG 1973 OPUS 15								
PRESS	TIME	T-AIR	F-UP	F-DN	F-NET	COOL	Q-MIX	R-HUM
(MB)	(MIN)	(DEG C)	(LY/MIN)	(LY/MIN)	(LY/MIN)	(DEG/DA)	(GM/KG)	(PC)
873.1	0.0	54.0	0.9341	0.8506	0.0835	0.0	13.011	42
841.7	1.0	26.7	0.9301	0.8146	0.1155	-5.9	11.511	44
810.5	2.0	23.3	0.9156	0.7835	0.1320	-2.2	10.319	46
779.4	3.0	19.5	0.9014	0.7549	0.1464	-2.0	8.733	48
749.6	4.0	15.8	0.8824	0.7296	0.1529	-1.3	7.696	51
720.6	5.0	13.0	0.8655	0.7085	0.1570	-0.8	7.130	54
693.3	6.0	10.2	0.8497	0.6914	0.1583	-0.4	6.524	57
666.4	7.0	7.2	0.8409	0.6790	0.1619	-0.4	5.793	60
641.9	8.0	4.7	0.8242	0.6641	0.1601	-1.1	5.242	64
619.5	9.0	3.2	0.8077	0.6421	0.1656	-2.3	4.945	63
599.2	10.0	2.1	0.7939	0.6148	0.1791	-3.3	4.720	63
578.9	11.0	0.4	0.7882	0.5929	0.1953	-3.0	2.477	36
559.0	12.0	-1.7	0.7835	0.5816	0.2020	-2.3	2.185	36
538.9	13.0	-4.1	0.7776	0.5712	0.2063	-2.1	1.745	33
519.2	14.0	-6.1	0.7726	0.5593	0.2133	-2.4	1.515	33
499.8	15.0	-7.5	0.7699	0.5454	0.2245	-2.3	1.432	32
481.3	16.0	-8.7	0.7697	0.5375	0.2322	-1.7	1.335	32
462.7	17.0	-10.7	0.7676	0.5333	0.2343	-1.0	1.188	32
444.3	18.0	-13.3	0.7621	0.5263	0.2357	-1.2	1.033	33
425.9	19.0	-16.2	0.7536	0.5154	0.2383	-2.1	0.819	32
407.8	20.0	-19.0	0.7512	0.5028	0.2484	-3.1	0.679	32
390.3	21.0	-21.5	0.7505	0.4897	0.2608	-3.3	0.575	32
373.8	22.0	-23.9	0.7479	0.4772	0.2707	-2.7	0.483	32
358.1	23.0	-26.2	0.7435	0.4683	0.2752	-1.6	0.409	32
341.7	24.0	-28.6	0.7399	0.4615	0.2783	-1.1	0.350	32
325.5	25.0	-31.1	0.7357	0.4572	0.2785	-1.4	0.282	32
309.5	26.0	-33.3	0.7333	0.4489	0.2844	-1.6	0.242	32
294.4	27.0	-35.4	0.7311	0.4394	0.2906	-1.7	0.213	32
279.7	28.0	-37.8	0.7236	0.4301	0.2935	-1.5	0.171	32
266.2	29.0	-40.5	0.7204	0.4253	0.2952	-1.7	0.137	32
252.9	30.0	-43.3	0.7206	0.4205	0.3001	-1.8	0.108	32
239.9	31.0	-46.2	0.7206	0.4142	0.3065	-2.0	0.083	32
227.3	32.0	-49.3	0.7192	0.4110	0.3083	-1.5	0.062	32
214.0	33.0	-52.0	0.7201	0.4077	0.3124	-0.9		A
202.5	34.0	-54.5	0.7163	0.4036	0.3128	-0.5		A
190.6	35.0	-57.0	0.7113	0.3973	0.3140	-0.3		A
179.2	36.0	-59.3	0.7039	0.3913	0.3126	-0.8		A
168.0	37.0	-61.0	0.7019	0.3859	0.3160	-1.8		A
158.1	38.0	-64.0	0.7029	0.3839	0.3169	-2.5		A
148.9	39.0	-66.3	0.7086	0.3819	0.3267	-1.9		A
140.0	40.0	-68.2	0.7096	0.3819	0.3278	-0.3		A
131.0	41.0	-69.4	0.7050	0.3784	0.3267	0.2		A
121.8	42.0	-68.8	0.6953	0.3703	0.3249	0.3		A
113.3	43.0	-67.8	0.6890	0.3624	0.3266	0.5		A
106.1	44.0	-67.4	0.6860	0.3604	0.3255	0.0		A
99.4	45.0	-66.9	0.6857	0.3628	0.3228	-0.7		A
92.6	46.0	-65.2	0.6882	0.3615	0.3267	-1.8		A
85.9	47.0	-63.5	0.6928	0.3625	0.3302	-1.6		A
79.9	48.0	-62.2	0.6959	0.3638	0.3321	0.0		A
74.3	49.0	-62.0	0.6961	0.3672	0.3289	0.9		A
69.2	50.0	-61.7	0.6957	0.3687	0.3271	0.3		A
64.3	51.0	-61.5	0.6950	0.3666	0.3284	-1.8		A
59.8	52.0	-59.7	0.6911	0.3599	0.3312	-3.3		A
55.6	53.0	-57.7	0.6877	0.3538	0.3339	-4.6		A
51.7	54.0	-55.8	0.6843	0.3478	0.3365	-6.4		A
48.3	55.0	-54.4	0.6847	0.3432	0.3415	-7.9		A
45.3	56.0	-52.7	0.6851	0.3380	0.3472	-6.8		A
42.6	57.0	-51.5	0.6848	0.3343	0.3505	-3.7		A
39.9	58.0	-50.5	0.6816	0.3324	0.3491	-1.2		A
37.3	59.0	-49.7	0.6822	0.3330	0.3492	-2.2		A
35.0	60.0	-49.2	0.6871	0.3367	0.3505	-6.7		A

32.8	61.0	-49.3	0.6957	0.3413	0.3543	-10.5	A
30.5	62.0	-49.3	0.7007	0.3411	0.3597	-11.1	A
28.2	63.0	-49.7	0.7063	0.3413	0.3651	-8.2	A
26.2	64.0	-49.9	0.7086	0.3403	0.3660	-3.0	A
24.6	65.0	-49.5	0.7059	0.3402	0.3656	3.3	A
23.0	66.0	-48.3	0.7037	0.3396	0.3641	8.0	A
21.3	67.0	-46.4	0.6999	0.3386	0.3613	10.3	A
20.0	67.8	-44.3	0.6956	0.3375	0.3580	14.2	A

1 FILTERED RADIOMETER SONDE RUN FOR WSL 11 AUG 1973 OPUS 16								
PRESS	TIME	T-AIR	F-UP	F-DN	F-NET	COOL	Q-MIX	R-HUM
(MB)	(MIN)	(DEG C)	(LY/MIN)	(LY/MIN)	(LY/MIN)	(DEG/DA)	(GM/KG)	(PC)
873.7	0.0	40.0	0.7842	0.7111	0.0731	0.0	16.029	47
850.0	1.0	27.5	0.4344	0.7071	0.1273	-13.4	8.491	33
826.1	2.0	24.1	0.8193	0.7012	0.1177	2.9	7.930	34
801.2	3.0	21.7	0.8006	0.6877	0.1129	1.1	7.382	36
778.7	4.0	18.8	0.7825	0.6728	0.1096	0.5	7.067	44
758.5	5.0	16.6	0.7667	0.6576	0.1091	-0.5	7.170	46
739.9	6.0	15.1	0.7583	0.6471	0.1112	-1.5	7.055	48
723.8	7.0	13.7	0.7507	0.6293	0.1213	-1.8	6.884	49
709.0	8.0	11.6	0.7399	0.6139	0.1260	-1.5	6.290	51
690.1	9.0	9.3	0.7305	0.6027	0.1278	-1.4	5.601	53
667.6	10.0	6.8	0.7204	0.5904	0.1300	-2.2	5.183	55
644.1	11.0	4.3	0.7173	0.5741	0.1432	-3.2	4.767	59
621.7	12.0	1.7	0.7084	0.5492	0.1592	-4.1	4.379	63
600.6	13.0	-0.3	0.6995	0.5241	0.1754	-4.4	4.131	66
580.6	14.0	-2.0	0.6890	0.4989	0.1902	-4.5	3.595	62
561.1	15.0	-4.0	0.6808	0.4763	0.2045	-5.0	3.472	68
540.8	16.0	-6.3	0.6747	0.4538	0.2209	-5.6	2.950	66
521.3	17.0	-8.2	0.6693	0.4259	0.2434	-5.8	2.049	52
502.7	18.0	-9.5	0.6653	0.4019	0.2634	-5.4	1.222	33
485.3	19.0	-10.1	0.6584	0.3819	0.2765	-3.1	1.101	30
467.6	20.0	-11.2	0.6516	0.3642	0.2874	-1.4	1.035	29
450.2	21.0	-13.2	0.6299	0.3512	0.2787	-1.5	0.906	29
434.3	22.0	-15.4	0.6252	0.3424	0.2828	-4.5	0.748	28
420.7	23.0	-17.5	0.6335	0.3337	0.2998	-6.4	0.666	28
408.2	24.0	-19.8	0.6592	0.3251	0.3341	-5.7	0.568	28
385.9	25.0	-21.6	0.6436	0.3177	0.3259	-3.3	0.479	29
364.2	26.0	-23.1	0.6422	0.3116	0.3306	-1.4	0.466	29
371.7	27.0	-24.8	0.6423	0.3064	0.3359	-2.3	0.466	29
357.7	28.0	-27.0	0.6420	0.2978	0.3442	3.1	0.354	30
343.8	29.0	-29.2	0.6302	0.2853	0.3448	14.0	0.315	31
330.3	30.0	-31.3	0.6737	0.2826	0.2911	25.3	0.245	29
317.2	31.0	-33.5	0.4845	0.2851	0.1994	28.3	0.214	29
304.3	32.0	-35.4	0.4119	0.2834	0.1285	20.0	0.183	29
292.8	33.0	-37.2	0.4001	0.2795	0.1205	8.0	0.166	30
282.0	34.0	-39.0	0.4046	0.2820	0.1226	-0.9	0.143	30
271.0	35.0	-40.8	0.4056	0.2807	0.1249	-2.7	0.123	30
259.8	36.0	-42.8	0.4059	0.2713	0.1346	-2.1	0.108	30
249.4	37.0	-44.9	0.4025	0.2630	0.1395	0.2	0.085	30
239.7	38.0	-47.3	0.3931	0.2590	0.1342	3.5	0.073	31
230.0	39.0	-48.7	0.3792	0.2556	0.1236	4.2	0.057	30
220.3	40.0	-50.6	0.3680	0.2550	0.1130	1.0	0.057	30
210.7	41.0	-52.6	0.3654	0.2455	0.1159	-3.1		A
200.9	42.0	-55.1	0.3719	0.2425	0.1294	-6.5		A
191.3	43.0	-57.1	0.3760	0.2347	0.1412	-6.4		A
183.1	44.0	-59.4	0.3769	0.2245	0.1523	-4.7		A
175.7	45.0	-61.5	0.3734	0.2213	0.1521	-3.6		A
168.3	46.0	-63.1	0.3713	0.2148	0.1564	-2.6		A
160.5	47.0	-64.4	0.3724	0.2105	0.1619	-2.8		A
153.7	48.0	-65.6	0.3760	0.2118	0.1642	-2.5		A
147.6	49.0	-66.8	0.3774	0.2125	0.1649	-2.0		A
142.2	50.0	-68.2	0.3760	0.2072	0.1688	-1.6		A
135.7	51.0	-69.2	0.3701	0.2004	0.1697	-1.8		A
129.2	52.0	-69.9	0.3615	0.1917	0.1698	-2.9		A
123.1	53.0	-70.8	0.3594	0.1853	0.1741	-5.5		A
118.0	54.0	-71.6	0.3640	0.1821	0.1819	-10.2		A
112.8	55.0	-71.4	0.3700	0.1796	0.1904	-15.9		A
107.0	56.0	-70.5	0.3835	0.1753	0.2083	-21.8		A
101.2	57.0	-69.6	0.4032	0.1681	0.2351	-25.4		A
96.0	58.0	-68.4	0.4235	0.1604	0.2630	-25.1		A
91.3	59.0	-67.0	0.4348	0.1549	0.2799	-20.1		A
87.0	60.0	-66.1	0.4432	0.1508	0.2924	-11.9		A

83.0	61.0	-66.0	0.4461	0.1489	0.2971	-4.6	A
79.1	62.0	-65.6	0.4446	0.1473	0.2973	2.0	A
74.9	63.0	-64.9	0.4436	0.1501	0.2934	4.7	A
71.0	64.0	-64.6	0.4443	0.1570	0.2874	2.2	A
67.3	65.0	-64.6	0.4503	0.1641	0.2862	-5.1	A
63.7	66.0	-62.8	0.4532	0.1614	0.2937	-15.1	A
60.5	67.0	-60.7	0.4641	0.1582	0.3059	-23.7	A
57.4	68.0	-59.6	0.4764	0.1554	0.3210	-25.1	A
54.6	69.0	-59.4	0.4896	0.1535	0.3361	-22.8	A
52.0	70.0	-58.1	0.4967	0.1554	0.3413	-19.8	A
49.4	71.0	-57.0	0.5083	0.1594	0.3489	-22.6	A
46.9	72.0	-56.2	0.5200	0.1610	0.3590	-34.5	A
44.7	73.0	-55.4	0.5339	0.1585	0.3753	-44.7	A
42.7	74.0	-54.5	0.5491	0.1527	0.3964	-43.7	A
40.7	75.0	-53.8	0.5595	0.1476	0.4119	-26.7	A
38.8	76.0	-53.3	0.5609	0.1458	0.4151	-7.9	A
37.0	77.0	-52.7	0.5552	0.1454	0.4098	3.4	A
35.1	78.0	-52.8	0.5582	0.1479	0.4102	5.1	A
33.2	79.0	-53.2	0.5623	0.1535	0.4088	0.9	A
31.4	80.0	-53.1	0.5663	0.1594	0.4074	-6.0	A
29.7	81.0	-52.5	0.5733	0.1635	0.4098	-20.0	A
28.0	82.0	-52.4	0.5847	0.1660	0.4187	-36.2	A
26.4	83.0	-52.1	0.5984	0.1664	0.4320	-53.0	A
25.1	84.0	-51.5	0.6108	0.1649	0.4459	-68.0	A
23.8	85.0	-50.5	0.6250	0.1630	0.4620	-75.6	A
22.6	86.0	-49.7	0.6414	0.1607	0.4806	-72.6	A
21.2	87.0	-48.7	0.6554	0.1584	0.4970	-56.1	A
20.0	88.0	-48.1	0.6672	0.1604	0.5068	-34.0	A
19.0	89.0	-47.6	0.6751	0.1670	0.5081	-29.5	A
18.1	90.0	-46.7	0.6825	0.1750	0.5074	-57.7	A
17.2	91.0	-45.7	0.6969	0.1754	0.5215	-93.7	A
16.3	92.0	-45.1	0.7179	0.1727	0.5452	-88.0	A
15.5	93.0	-44.6	0.7303	0.1694	0.5609	-14.0	A
14.6	94.0	-43.6	0.7219	0.1699	0.5521	59.8	A
14.1	94.6	-42.9	0.7104	0.1708	0.5397	140.2	A

1 FILTERED RADIOMETER SONDE RUN FOR WSL 12 AUG 1973 OPUS 17									
PRESS	TIME	T-AIR	F-UF	F-DN	F-NET	COOL	Q-MIX	R-HUM	
(MD)	(MIN)	(DEG C)	(LY/MIN)	(LY/MIN)	(LY/MIN)	(DEG/DA)	(GM/KG)	(PC)	
879.5	0.0	27.0	0.6618	0.6372	0.0246	0.0	13.956	62	
817.8	2.0	19.0	0.7338	0.6247	0.1090	-8.0	9.728	58	
786.9	3.0	16.7	0.7209	0.6175	0.1032	-0.3	8.972	58	
754.8	4.0	14.9	0.7089	0.6062	0.1027	-0.9	7.951	56	
725.9	5.0	12.5	0.7041	0.5899	0.1142	-1.9	6.922	54	
699.7	6.0	10.0	0.7025	0.5742	0.1272	-2.4	6.363	58	
674.1	7.0	7.6	0.6993	0.5623	0.1370	-2.4	5.459	56	
649.0	8.0	5.5	0.6946	0.5466	0.1450	-2.4	4.333	49	
625.0	9.0	3.7	0.6916	0.5352	0.1563	-2.4	3.245	41	
602.1	10.0	2.1	0.6880	0.5207	0.1673	-2.2	2.593	35	
579.9	11.0	0.2	0.6853	0.5110	0.1744	-1.7	2.406	35	
558.1	12.0	-2.0	0.6847	0.5061	0.1785	-1.3	2.527	43	
535.6	13.0	-4.1	0.6840	0.5008	0.1832	-1.2	2.536	48	
513.5	14.0	-5.9	0.6801	0.4933	0.1867	-1.5	2.089	43	
492.8	15.0	-7.7	0.6741	0.4822	0.1919	-2.1	2.007	46	
474.2	16.0	-9.7	0.6684	0.4680	0.2003	-3.2	1.381	35	
455.4	17.0	-11.7	0.6658	0.4539	0.2120	-4.2	1.224	35	
437.9	18.0	-13.6	0.6690	0.4410	0.2280	-4.6	1.105	36	
421.5	19.0	-15.6	0.6711	0.4283	0.2428	-3.8	1.021	37	
406.1	20.0	-17.5	0.6694	0.4183	0.2511	-2.3	0.959	38	
390.0	21.0	-19.5	0.6639	0.4112	0.2527	-1.4	0.709	34	
373.8	22.0	-21.5	0.6563	0.4124	0.2539	-1.9	0.531	28	
358.3	23.0	-24.0	0.6503	0.3993	0.2610	-2.8	0.434	28	
343.8	24.0	-26.7	0.6485	0.3765	0.2719	-3.3	0.365	29	
330.0	25.0	-29.2	0.6499	0.3709	0.2790	-2.9	0.295	28	
315.8	26.0	-31.4	0.6514	0.3652	0.2852	-2.1	0.256	29	
302.4	27.0	-33.5	0.6508	0.3614	0.2894	-1.0	0.216	28	
289.7	28.0	-35.8	0.6490	0.3586	0.2934	-0.0	0.181	29	
276.9	29.0	-38.1	0.6452	0.3574	0.2878	0.6	0.151	29	
264.5	30.0	-40.6	0.6427	0.3562	0.2824	0.8	0.126	29	
252.5	31.0	-43.2	0.6396	0.3547	0.2849	0.9	0.101	30	
239.9	32.0	-45.7	0.6378	0.3542	0.2836	0.9	0.080	29	
227.6	33.0	-47.9	0.6337	0.3537	0.2800	-0.1	0.066	30	
216.5	34.0	-50.1	0.6311	0.3516	0.2795	-2.1	0.056	30	
206.3	35.0	-52.3	0.6301	0.3424	0.2877	-4.5		A	
196.0	36.0	-54.3	0.6290	0.3300	0.2990	-4.5		A	
185.7	37.0	-55.9	0.6270	0.3173	0.3097	-1.9		A	
175.4	38.0	-57.6	0.6255	0.3169	0.3086	1.8		A	
165.7	39.0	-60.1	0.6253	0.3257	0.2996	4.4		A	
157.4	40.0	-62.6	0.6233	0.3339	0.2894	4.1		A	
149.7	41.0	-64.8	0.6200	0.3343	0.2858	1.7		A	
142.0	42.0	-66.5	0.6161	0.3292	0.2869	-0.3		A	
134.3	43.0	-68.2	0.6152	0.3259	0.2892	-0.5		A	
126.7	44.0	-69.5	0.6171	0.3275	0.2895	-0.2		A	
119.1	45.0	-70.0	0.6192	0.3315	0.2877	-0.3		A	
110.8	46.0	-69.6	0.6225	0.3338	0.2887	-1.5		A	
103.5	47.0	-68.9	0.6243	0.3326	0.2918	-3.0		A	
97.6	48.0	-67.9	0.6266	0.3297	0.2969	-3.7		A	
93.1	49.0	-66.8	0.6268	0.3266	0.3002	-3.0		A	
88.9	50.0	-65.5	0.6250	0.3233	0.3017	-2.0		A	
85.1	51.0	-64.5	0.6230	0.3222	0.3008	-4.0		A	
81.2	52.0	-64.0	0.6262	0.3226	0.3036	-7.7		A	
77.2	53.0	-63.7	0.6360	0.3236	0.3124	-9.1		A	
73.4	54.0	-61.9	0.6443	0.3228	0.3215	-4.6		A	
69.6	55.0	-59.5	0.6477	0.3259	0.3218	3.7		A	
66.0	56.0	-58.0	0.6490	0.3353	0.3137	8.8		A	
62.3	57.0	-57.8	0.6518	0.3472	0.3046	6.9		A	
58.8	58.0	-57.7	0.6535	0.3506	0.3029	-0.1		A	
55.2	59.0	-56.9	0.6557	0.3497	0.3060	-6.2		A	
51.7	60.0	-55.6	0.6586	0.3452	0.3134	-5.4		A	
48.5	61.0	-54.6	0.6633	0.3459	0.3174	-0.5		A	

45.6	62.0	-54.3	0.6691	0.3567	0.3124	3.1	A
42.4	63.0	-54.4	0.6727	0.3649	0.3078	3.1	A
40.3	64.0	-54.1	0.6719	0.3615	0.3104	0.6	A
37.6	65.0	-53.6	0.6700	0.3584	0.3116	1.4	A
34.7	66.0	-53.7	0.6735	0.3644	0.3091	6.4	A
31.5	67.0	-53.6	0.6784	0.3733	0.3091	10.5	A
29.5	68.0	-52.3	0.6772	0.3784	0.2989	15.9	A
27.2	69.0	-50.0	0.6678	0.3755	0.2922	17.5	A
25.2	70.0	-48.5	0.6621	0.3767	0.2854	13.4	A
23.8	71.0	-47.8	0.6640	0.3819	0.2821	-2.5	A
22.7	72.0	-47.1	0.6707	0.3861	0.2847	-26.1	A
21.4	73.0	-45.5	0.6788	0.3832	0.2955	-35.5	A
20.2	74.0	-43.9	0.6823	0.3763	0.3060	-21.9	A
19.1	75.0	-42.9	0.6790	0.3711	0.3080	2.9	A
17.9	76.0	-42.6	0.6717	0.3711	0.3006	14.9	A
16.7	77.0	-42.2	0.6679	0.3726	0.2953	12.6	A
15.5	78.0	-41.8	0.6729	0.3758	0.2970	-1.9	A
14.2	79.0	-42.1	0.6789	0.3821	0.2968	-15.0	A
13.0	80.0	-43.0	0.6889	0.3871	0.3018	-12.9	A
11.9	81.0	-43.4	0.6978	0.3896	0.3082	1.5	A
10.9	82.0	-42.7	0.6977	0.3939	0.3038	25.2	A
10.0	82.9	-41.2	0.6927	0.3972	0.2955	58.1	A

1FILTREFD RADICHTERSONDE RUN FOR WCD 11 AUG 1973 OPUS 18									
PRESS	TIME	T-AIR	F-UP	F-DN	F-NET	COOL	Q-MIX	R-HUM	
(MD)	(MIN)	(DEG C)	(LY/MIN)	(LY/MIN)	(LY/MIN)	(DEG/DA)	(GM/KG)	(PC)	
878.1	0.0	47.0	1.8567	0.8908	-0.0341	0.0	14.893	34	
839.6	1.0	30.3	1.3574	0.8821	0.4753	-77.8	15.730	50	
806.0	2.0	25.4	1.3286	0.8497	0.4789	-0.3	13.439	51	
777.6	3.0	21.6	1.2792	0.8163	0.4549	3.4	10.157	50	
753.6	4.0	18.4	1.2426	0.8044	0.4382	4.6	9.105	51	
730.9	5.0	16.1	1.2473	0.8265	0.4177	3.5	8.208	52	
707.0	6.0	13.7	1.2261	0.8207	0.4054	0.0	7.455	53	
683.2	7.0	11.1	1.2018	0.7357	0.4061	-2.9	6.843	56	
659.0	8.0	8.9	1.2061	0.7629	0.4432	-5.1	6.151	57	
640.3	9.0	7.4	1.2299	0.7741	0.4558	-3.4	5.874	58	
620.1	10.0	5.9	1.2368	0.7651	0.4717	0.8	5.385	56	
599.8	11.0	3.7	1.1908	0.7389	0.4519	3.0	4.518	55	
577.4	12.0	1.2	1.1363	0.7059	0.4304	2.9	3.867	53	
559.5	13.0	-1.0	1.1114	0.6863	0.4252	0.3	3.419	54	
539.6	14.0	-3.2	1.1059	0.6765	0.4354	-2.0	2.851	50	
520.3	15.0	-5.1	1.1014	0.6572	0.4443	-2.3	2.493	49	
502.3	16.0	-6.3	1.0925	0.6392	0.4532	-1.4	1.873	40	
485.4	17.0	-7.2	1.0726	0.6209	0.4518	-0.4	1.704	36	
468.3	18.0	-8.7	1.0600	0.6069	0.4530	0.4	1.516	36	
450.9	19.0	-11.1	1.0521	0.6011	0.4510	-0.1	1.326	36	
433.9	20.0	-13.3	1.0425	0.5941	0.4484	-0.9	1.112	35	
417.2	21.0	-15.4	1.0397	0.5844	0.4553	-1.6	0.985	35	
400.7	22.0	-17.6	1.0341	0.5707	0.4635	-1.8	0.838	35	
385.4	23.0	-19.9	1.0241	0.5587	0.4654	-0.8	0.727	35	
370.6	24.0	-22.0	1.0128	0.5448	0.4679	0.8	0.628	35	
356.3	25.0	-24.2	0.9996	0.5362	0.4634	2.8	0.549	35	
341.7	26.0	-26.3	0.9871	0.5325	0.4546	4.4	0.439	34	
328.4	27.0	-28.4	0.9701	0.5325	0.4375	4.8	0.402	35	
315.5	28.0	-30.4	0.9583	0.5290	0.4293	4.2	0.343	35	
303.5	29.0	-32.4	0.9451	0.5233	0.4219	2.2	0.291	35	
291.6	30.0	-34.2	0.9331	0.5149	0.4181	0.2	0.262	35	
280.3	31.0	-35.9	0.9223	0.5118	0.4205	-0.7	0.221	35	
268.8	32.0	-38.1	0.9132	0.4855	0.4277	-0.2	0.191	35	
256.8	33.0	-40.4	0.9002	0.4761	0.4240	1.1	0.152	34	
244.1	34.0	-43.3	0.8934	0.4745	0.4188	1.6	0.121	34	
232.3	35.0	-46.1	0.8880	0.4741	0.4138	0.9	0.092	34	
221.6	36.0	-48.8	0.8797	0.4635	0.4162	0.2	0.072	34	
211.1	37.0	-51.2	0.8703	0.4537	0.4165	0.5		A	
201.3	38.0	-53.2	0.8624	0.4470	0.4154	1.0		A	
192.9	39.0	-55.2	0.8558	0.4453	0.4104	0.5		A	
184.8	40.0	-57.1	0.8524	0.4407	0.4117	-0.6		A	
176.1	41.0	-59.2	0.8515	0.4368	0.4147	-1.4		A	
166.9	42.0	-61.2	0.8475	0.4296	0.4179	-0.2		A	
158.3	43.0	-63.0	0.8430	0.4253	0.4176	1.4		A	
149.7	44.0	-64.9	0.8399	0.4276	0.4120	2.4		A	
141.2	45.0	-67.2	0.8412	0.4339	0.4073	2.0		A	
133.0	46.0	-69.2	0.8429	0.4368	0.4061	0.5		A	
126.3	47.0	-70.2	0.8430	0.4359	0.4070	-1.4		A	
119.5	48.0	-70.7	0.8432	0.4344	0.4088	-2.9		A	
112.1	49.0	-70.4	0.8408	0.4266	0.4142	-3.8		A	
105.5	50.0	-68.3	0.8337	0.4138	0.4198	-3.8		A	
100.9	51.0	-66.6	0.8266	0.4038	0.4227	-2.8		A	
96.0	52.0	-66.5	0.8213	0.3979	0.4234	-2.2		A	
89.9	53.0	-66.8	0.8195	0.3945	0.4250	-2.4		A	
84.1	54.0	-65.6	0.8172	0.3884	0.4288	-0.9		A	
79.5	55.0	-64.6	0.8149	0.3835	0.4315	2.8		A	
75.1	56.0	-63.8	0.8114	0.3873	0.4241	7.3		A	
71.0	57.0	-62.9	0.8084	0.3918	0.4166	10.8		A	
67.2	58.0	-62.2	0.8070	0.3970	0.4100	11.0		A	
63.6	59.0	-62.0	0.8060	0.4041	0.4019	9.1		A	
59.9	60.0	-61.4	0.8035	0.4072	0.3963	5.6		A	

56.5	61.0	-60.2	0.8000	0.4046	0.3955	1.9	A
53.3	62.0	-56.5	0.7939	0.3973	0.3966	-1.1	A
50.4	63.0	-57.2	0.7875	0.3910	0.3965	-4.5	A
47.3	64.0	-55.8	0.7836	0.3849	0.3987	-8.6	A
44.4	65.0	-54.6	0.7815	0.3787	0.4058	-13.5	A
41.9	66.0	-53.9	0.7847	0.3715	0.4132	-13.6	A
39.7	67.0	-53.8	0.7850	0.3650	0.4200	-5.2	A
37.5	68.0	-53.3	0.7829	0.3630	0.4197	8.6	A
35.4	69.0	-52.0	0.7813	0.3638	0.4125	18.7	A
33.1	70.0	-50.2	0.7790	0.3779	0.4012	17.9	A
31.0	71.0	-49.1	0.7777	0.3830	0.3947	8.6	A
29.1	72.0	-49.0	0.7750	0.3790	0.3959	-2.0	A
27.4	73.0	-49.2	0.7713	0.3707	0.4006	-7.0	A
25.9	74.0	-49.0	0.7689	0.3677	0.4012	-8.6	A
24.4	75.0	-48.7	0.7704	0.3687	0.4017	-11.6	A
22.8	76.0	-46.8	0.7757	0.3690	0.4067	-16.1	A
21.3	77.0	-49.3	0.7841	0.3708	0.4133	-14.1	A
19.9	78.0	-49.5	0.7886	0.3726	0.4160	-5.4	A
18.7	79.0	-49.1	0.7869	0.3728	0.4141	2.3	A
17.4	80.0	-47.7	0.7831	0.3706	0.4125	0.7	A
16.2	81.0	-45.6	0.7800	0.3674	0.4126	-5.8	A
15.1	82.0	-43.9	0.7793	0.3639	0.4160	-10.4	A
14.2	83.0	-42.5	0.7792	0.3612	0.4180	-7.0	A
13.5	84.0	-40.8	0.7761	0.3578	0.4183	1.0	A
12.8	85.0	-39.0	0.7702	0.3538	0.4164	2.9	A
12.1	86.0	-37.9	0.7668	0.3507	0.4161	4.0	A
11.4	87.0	-37.2	0.7654	0.3480	0.4173	8.2	A
10.7	88.0	-36.5	0.7627	0.3473	0.4154	17.0	A
10.0	89.1	-35.9	0.7593	0.3477	0.4116	30.7	A

1 FILTERED RADIO METER SOND T RUN FOR WSO 11 AUG 1973 OPUS 19								
PRESS	TIME	T-AIR	F-UP	F-DN	F-NET	COOL	Q-MIX	R-HUM
(MB)	(MIN)	(DEG C)	(LY/MIN)	(LY/MIN)	(LY/MIN)	(DEG/DA)	(GM/KG)	(PC)
877.3	0.0	36.0	0.7448	0.6752	0.0696	0.0	5.140	13
851.1	1.0	30.6	0.7534	0.6812	0.0722	-0.6	8.424	26
826.9	2.0	27.3	0.7372	0.6917	0.0455	-0.5	9.571	35
805.1	3.0	25.2	0.7404	0.6748	0.0656	-2.7	8.861	35
784.5	4.0	23.1	0.7553	0.6654	0.0899	-4.2	8.582	38
763.8	5.0	20.9	0.7567	0.6514	0.1053	-3.4	8.303	41
744.0	6.0	18.8	0.7498	0.6397	0.1101	-2.0	8.106	44
724.0	7.0	16.8	0.7413	0.6260	0.1153	-1.4	7.914	48
704.3	8.0	14.9	0.7311	0.6123	0.1188	-1.5	7.670	51
683.6	9.0	12.9	0.7192	0.5938	0.1254	-1.3	7.155	52
661.2	10.0	10.6	0.7100	0.5788	0.1312	-1.2	6.458	53
636.9	11.0	7.7	0.6998	0.5669	0.1329	-1.4	5.675	54
611.8	12.0	4.8	0.6939	0.5548	0.1391	-2.5	5.401	61
587.4	13.0	2.2	0.6876	0.5366	0.1511	-3.7	4.749	61
564.7	14.0	0.4	0.6832	0.5089	0.17-3	-4.7	4.434	64
544.5	15.0	-1.4	0.6697	0.4821	0.1876	-5.3	3.509	54
525.6	16.0	-3.3	0.6585	0.4512	0.2074	-5.6	2.424	42
506.9	17.0	-5.2	0.6492	0.4252	0.2240	-5.6	1.400	27
488.3	18.0	-6.5	0.6491	0.4018	0.2473	-4.5	0.919	19
470.7	19.0	-7.6	0.6431	0.3877	0.2553	-3.8	0.889	19
454.2	20.0	-9.1	0.6383	0.3701	0.2602	-3.1	0.813	19
437.8	21.0	-11.3	0.6369	0.3539	0.2730	-2.9	0.720	19
422.1	22.0	-13.2	0.6313	0.3491	0.2823	-2.2	0.627	19
407.1	23.0	-15.5	0.6252	0.3408	0.2844	-0.9	0.579	20
393.0	24.0	-17.9	0.6109	0.3343	0.2826	-0.9	0.460	20
378.7	25.0	-20.5	0.6116	0.3272	0.2844	-1.6	0.404	20
364.3	26.0	-22.5	0.6043	0.3105	0.2938	-2.2	0.347	20
349.6	27.0	-24.7	0.5997	0.3010	0.2988	-1.9	0.303	20
335.4	28.0	-27.0	0.5976	0.2946	0.3030	-1.5	0.258	20
321.7	29.0	-29.5	0.5909	0.2876	0.3033	-2.2	0.214	21
309.4	30.0	-31.6	0.5845	0.2736	0.3109	-3.3	0.182	21
297.7	31.0	-33.3	0.5776	0.2584	0.3191	-3.9	0.166	21
286.0	32.0	-35.1	0.5760	0.2467	0.3293	-2.6	0.144	21
274.2	33.0	-37.2	0.5738	0.2402	0.3335	-0.6	0.123	21
262.9	34.0	-39.3	0.5712	0.2417	0.3295	0.5	0.104	21
252.0	35.0	-41.5	0.5684	0.2437	0.3246	-0.7	0.087	21
240.9	36.0	-43.6	0.5666	0.2379	0.3287	-3.1	0.073	21
230.2	37.0	-46.1	0.5689	0.2284	0.3405	-4.3	0.060	22
219.9	38.0	-47.8	0.5707	0.2209	0.3499	-3.1	0.049	22
209.9	39.0	-49.9	0.5741	0.2215	0.3524	-1.1	0.046	22
200.1	40.0	-52.3	0.5760	0.2265	0.3495	-0.8		A
191.2	41.0	-54.8	0.5756	0.2261	0.3495	-2.9		A
182.7	42.0	-56.4	0.5756	0.2178	0.3578	-5.0		A
174.3	43.0	-58.1	0.5798	0.2099	0.3699	-5.8		A
165.9	44.0	-60.0	0.5842	0.2091	0.3751	-4.8		A
158.0	45.0	-62.3	0.5879	0.2058	0.3820	-2.9		A
149.8	46.0	-64.1	0.5853	0.2000	0.3853	-1.9		A
142.5	47.0	-65.8	0.5822	0.1978	0.3845	-1.5		A
135.4	48.0	-67.1	0.5786	0.1926	0.3860	-2.9		A
128.3	49.0	-68.3	0.5773	0.1865	0.3908	-5.2		A
120.8	50.0	-69.5	0.5792	0.1792	0.4001	-6.8		A
114.1	51.0	-69.9	0.5811	0.1723	0.4088	-6.5		A
108.1	52.0	-69.2	0.5847	0.1673	0.4174	-3.6		A
103.1	53.0	-67.7	0.5829	0.1657	0.4172	1.6		A
98.1	54.0	-67.5	0.5818	0.1687	0.4130	4.9		A
91.9	55.0	-67.6	0.5714	0.1678	0.4035	4.5		A
86.5	56.0	-66.9	0.5619	0.1610	0.4010	0.6		A
82.3	57.0	-65.1	0.5552	0.1523	0.4029	-5.9		A
78.7	58.0	-63.9	0.5575	0.1468	0.4107	-9.3		A
74.1	59.0	-63.0	0.5636	0.1433	0.4203	-7.5		A
69.8	60.0	-62.0	0.5662	0.1420	0.4243	-3.4		A

66.0	61.0	-61.3	0.5636	0.1402	0.4235	0.5	A
62.6	62.0	-60.5	0.5587	0.1381	0.4206	2.8	A
59.3	63.0	-59.6	0.5564	0.1358	0.4207	5.3	A
56.1	64.0	-58.7	0.5532	0.1356	0.4176	9.0	A
53.1	65.0	-57.8	0.5485	0.1381	0.4105	11.9	A
50.4	66.0	-56.2	0.5407	0.1385	0.4022	9.4	A
47.8	67.0	-54.7	0.5339	0.1347	0.3992	2.8	A
45.1	68.0	-53.5	0.5302	0.1285	0.4017	-1.7	A
42.6	69.0	-53.0	0.5285	0.1241	0.4043	-1.7	A
40.2	70.0	-52.4	0.5258	0.1224	0.4034	1.6	A
37.9	71.0	-51.6	0.5231	0.1211	0.4020	3.7	A
36.0	71.9	-50.9	0.5204	0.1203	0.4001	5.7	A

1 FILTERED RADIOMETER SCHEMATIC RUN FOR WSO 11 AUG 1973 OPUS 20									
PRESS (MM)	TIME (MIN)	T-AIR (DEG C)	F-UP (LY/MIN)	F-DN (LY/MIN)	F-NET (LY/MIN)	COOL (DEG/DA)	Q-MIX (GM/KG)	R-HUM (PC)	
879.6	0.0	23.0	0.6272	0.6221	0.4051	0.0	10.385	58	
853.6	1.0	20.7	0.6281	0.6330	0.3250	-72.3	10.377	57	
827.6	2.0	19.7	0.9240	0.6317	0.3233	-1.8	10.191	58	
801.8	3.0	18.1	0.9200	0.5993	0.3207	-0.2	9.744	60	
776.0	4.0	16.4	0.9172	0.5968	0.3204	-1.1	9.279	60	
750.7	5.0	14.5	0.9199	0.5485	0.3317	-1.6	8.169	59	
726.6	6.0	12.3	0.9200	0.5767	0.3414	-1.5	7.247	58	
702.5	7.0	10.1	0.9154	0.5702	0.3452	-1.3	6.526	58	
679.9	8.0	7.9	0.9081	0.5636	0.3446	-1.9	5.774	59	
656.9	9.0	5.6	0.9053	0.5497	0.3557	-2.7	4.822	55	
638.0	10.0	3.9	0.9051	0.5325	0.3727	-2.9	4.508	57	
616.0	11.0	2.7	0.9012	0.5214	0.3797	-2.2	3.315	43	
599.9	12.0	1.5	0.8979	0.5144	0.3835	-1.1	2.887	40	
581.1	13.0	-0.0	0.8934	0.5082	0.3852	-1.1	2.616	40	
560.1	14.0	-1.7	0.8899	0.5011	0.3888	-1.2	2.626	43	
537.0	15.0	-3.3	0.8856	0.4903	0.3956	-1.2	2.389	43	
519.7	16.0	-4.9	0.8805	0.4816	0.3989	-0.9	2.183	42	
501.3	17.0	-6.5	0.8750	0.4744	0.4006	-0.4	1.866	40	
484.3	18.0	-8.5	0.8669	0.4671	0.3998	-0.1	1.671	39	
468.2	19.0	-10.4	0.8590	0.4574	0.4016	0.7	1.457	40	
452.0	20.0	-12.0	0.8525	0.4532	0.3993	1.9	1.526	45	
440.7	21.0	-13.5	0.8451	0.4541	0.3910	2.3		M	
427.4	22.0	-15.2	0.8381	0.4550	0.3831	1.7	1.213	44	
411.3	23.0	-16.9	0.8282	0.4467	0.3815	1.1	1.093	43	
393.1	24.0	-18.5	0.8193	0.4369	0.3824	1.1	1.005	44	
380.3	25.0	-20.5	0.8118	0.4350	0.3768	1.6	0.863	43	
366.7	26.0	-22.6	0.8037	0.4337	0.3700	0.6	0.739	43	
353.3	27.0	-24.9	0.7964	0.4271	0.3693	-1.3	0.608	42	
339.9	28.0	-27.4	0.7913	0.4125	0.3789	-1.9	0.500	41	
326.9	29.0	-29.8	0.7863	0.4003	0.3865	-0.4	0.407	41	
314.1	30.0	-32.1	0.7806	0.3963	0.3823	1.9	0.338	40	
301.3	31.0	-33.9	0.7717	0.3995	0.3721	3.6	0.278	39	
294.0	32.0	-35.8	0.7620	0.3960	0.3660	2.1	0.253	39	
284.4	33.0	-37.7	0.7529	0.3883	0.3646	0.2	0.205	39	
272.1	34.0	-39.9	0.7494	0.3822	0.3672	-0.3	0.174	39	
257.2	35.0	-41.8	0.7460	0.3762	0.3698	0.5	0.150	39	
247.0	36.0	-43.9	0.7401	0.3731	0.3669	2.2	0.125	39	
235.8	37.0	-46.3	0.7327	0.3737	0.3590	2.9	0.101	39	
225.3	38.0	-48.3	0.7271	0.3746	0.3525	2.7	0.084	39	
215.8	39.0	-50.0	0.7232	0.3724	0.3508	1.9	0.074	39	
207.0	40.0	-51.6	0.7175	0.3693	0.3482	1.9		A	
197.9	41.0	-53.4	0.7111	0.3654	0.3456	3.1		A	
189.3	42.0	-55.2	0.7042	0.3639	0.3403	3.9		A	
180.7	43.0	-57.2	0.6991	0.3674	0.3316	3.8		A	
172.1	44.0	-59.5	0.6992	0.3728	0.3263	2.2		A	
162.9	45.0	-61.7	0.6981	0.3736	0.3245	0.3		A	
154.1	46.0	-63.6	0.6970	0.3692	0.3277	-0.4		A	
146.2	47.0	-65.1	0.6949	0.3654	0.3290	0.3		A	
138.5	48.0	-66.8	0.6938	0.3673	0.3265	1.9		A	
131.7	49.0	-68.5	0.6924	0.3653	0.3231	2.7		A	
125.6	50.0	-69.6	0.6900	0.3709	0.3191	2.4		A	
120.3	51.0	-70.5	0.6897	0.3718	0.3179	1.4		A	
113.5	52.0	-70.3	0.6882	0.3713	0.3169	0.4		A	
106.5	53.0	-69.4	0.6856	0.3685	0.3171	-0.0		A	
99.8	54.0	-68.1	0.6821	0.3648	0.3172	-0.4		A	
94.2	55.0	-67.5	0.6819	0.3640	0.3153	-0.3		A	
88.7	56.0	-67.1	0.6849	0.3663	0.3187	-0.3		A	
83.6	57.0	-66.6	0.6896	0.3717	0.3179	0.1		A	
78.7	58.0	-65.3	0.6930	0.3744	0.3187	-0.0		A	
74.1	59.0	-63.6	0.6923	0.3747	0.3176	-0.4		A	
69.7	60.0	-61.9	0.6931	0.3741	0.3190	-1.1		A	
65.3	61.0	-60.4	0.6951	0.3756	0.3195	-2.8		A	
61.4	62.0	-59.6	0.7000	0.3780	0.3220	-3.8		A	
56.9	63.3	-59.3	0.7097	0.3829	0.3268	-6.2		A	

1 FILTERED RADIOMETER SOND ² RUN FOR PH5 6 SEP 1973 OPUS 21								
PRESS	TIME	T-AIR	F-UP	F-DN	F-NET	COOL	Q-MIX	R-HUM
(MB)	(MIN)	(DEG C)	(LY/MIN)	(LY/MIN)	(LY/FIN)	(DEG/DA)	(GH/KG)	(PC)
953.8	0.0	35.0	0.7352	0.6955	0.0397	0.0	11.898	39
929.6	1.0	34.9	0.7611	0.6798	0.0813	-10.1	14.910	39
904.6	2.0	35.4	0.7628	0.6737	0.0891	-3.0	15.568	39
879.5	3.0	32.4	0.7727	0.6741	0.0986	-2.7	14.012	39
852.6	4.0	29.1	0.7809	0.6673	0.1136	-2.6	11.355	40
825.8	5.0	26.3	0.7858	0.6577	0.1281	-1.6	11.593	43
799.9	6.0	24.3	0.7819	0.6492	0.1327	0.2	10.518	45
774.4	7.0	21.7	0.7703	0.6468	0.1240	1.4	9.383	44
749.7	8.0	19.6	0.7529	0.6410	0.1119	0.8	8.012	42
724.8	9.0	17.2	0.7378	0.6340	0.1078	-1.2	7.477	43
699.3	10.0	14.7	0.7322	0.6075	0.1227	-2.5	6.602	44
674.6	11.0	12.1	0.7220	0.5781	0.1440	-1.2	5.861	45
651.0	12.0	9.6	0.7102	0.5648	0.1455	1.7	5.248	45
629.2	13.0	7.2	0.6957	0.5737	0.1219	4.0	6.716	66
608.3	14.0	4.6	0.6866	0.5862	0.1004	3.4	6.540	74
587.7	15.0	1.9	0.6790	0.5865	0.0925	0.3	5.967	78
566.8	16.0	-0.8	0.6725	0.5736	0.0989	-3.7	5.208	82
546.4	17.0	-2.8	0.6662	0.5488	0.1174	-7.3	5.128	90
525.9	18.0	-3.9	0.6656	0.5117	0.1538	-9.3	2.274	41
505.4	19.0	-4.5	0.6684	0.4749	0.1935	-8.3	1.447	27
486.8	20.0	-5.0	0.6703	0.4518	0.2185	-5.4	1.430	26
470.0	21.0	-5.2	0.6673	0.4453	0.2220	-2.5	1.441	26
454.0	22.0	-5.6	0.6628	0.4403	0.2225	-1.2	1.464	26
439.2	23.0	-6.9	0.6626	0.4360	0.2266	-1.8	1.415	26
424.7	24.0	-9.2	0.6658	0.4340	0.2318	-2.9	1.148	26
410.4	25.0	-11.7	0.6687	0.4290	0.2397	-2.8	0.929	24
391.4	26.0	-14.0	0.6718	0.4194	0.2523	-2.8	0.840	25
375.6	27.0	-16.4	0.6740	0.4173	0.2567	-2.3	0.709	25
363.1	28.0	-18.6	0.6725	0.4123	0.2603	-1.8	0.622	25
354.1	29.0	-20.8	0.6677	0.4045	0.2632	-2.3	0.560	26
339.8	30.0	-22.9	0.6646	0.3956	0.2689	-2.6	0.469	26
327.3	31.0	-25.1	0.6663	0.3922	0.2741	-4.1	0.413	27
314.7	32.0	-27.2	0.6727	0.3887	0.2840	-4.9	0.353	26
302.3	33.0	-29.4	0.6806	0.3808	0.2998	-5.2	0.293	26
289.7	34.0	-31.7	0.6839	0.3754	0.3085	-4.6	0.255	27
277.0	35.0	-33.8	0.6872	0.3700	0.3172	-4.0	0.215	27
264.1	36.0	-35.9	0.6897	0.3648	0.3249	-3.5	0.184	27

1 FILTERED RADIOMETER SONDE RUN FOR PHS 6 SEP 1973 OPUS 22								
PRESS	TIME	T-AIR	F-UP	F-DN	F-NET	COOL	Q-MIX	R-HUM
(MB)	(MIN)	(DEG C)	(LY/MIN)	(LY/MIN)	(LY/MIN)	(DEG C/DA)	(GM/KG)	(PC)
954.2	0.0	20.2	0.4915	0.7999	0.0916	0.0	10.651	41
925.2	1.0	26.5	0.9534	0.7931	0.1603	-13.9	9.944	42
896.8	2.0	24.4	0.9506	0.7931	0.1575	0.6	9.332	43
869.1	3.0	22.3	0.9454	0.7910	0.1544	0.3	8.600	44
842.1	4.0	20.2	0.9362	0.7836	0.1526	-0.4	7.628	43
815.9	5.0	18.3	0.9296	0.7727	0.1559	-0.9	6.775	42
790.1	6.0	16.1	0.9253	0.7604	0.1650	-0.7	6.102	41
763.7	7.0	13.4	0.9193	0.7501	0.1692	0.3	5.550	44
737.3	8.0	10.7	0.9027	0.7403	0.1624	1.2	4.819	44
710.7	9.0	8.1	0.8848	0.7342	0.1506	1.4	4.877	50
685.4	10.0	5.4	0.8738	0.7266	0.1472	0.8	4.795	58
662.0	11.0	3.2	0.8624	0.7151	0.1473	0.2	4.645	65
639.6	12.0	1.0	0.8522	0.7051	0.1470	-0.3	5.349	79
617.5	13.0	-1.2	0.8398	0.6928	0.1470	-0.9	4.724	86
595.5	14.0	-3.6	0.8299	0.6767	0.1532	-1.8	1.389	28
574.2	15.0	-4.6	0.8218	0.6601	0.1617	-3.0	1.300	28
554.5	16.0	-5.2	0.8200	0.6471	0.1729	-3.7	1.242	26
536.2	17.0	-5.4	0.8235	0.6352	0.1884	-3.5	1.236	25
518.6	18.0	-5.6	0.8292	0.6284	0.2008	-2.3	1.230	25
500.4	19.0	-6.5	0.8240	0.6265	0.2025	-1.1	1.219	25
483.7	20.0	-8.2	0.8277	0.6270	0.2008	-0.9	1.090	25
467.7	21.0	-10.7	0.8279	0.6232	0.2047	-1.3	0.943	25
451.7	22.0	-13.2	0.8262	0.6143	0.2119	-1.5	0.789	26
435.5	23.0	-15.5	0.8214	0.6067	0.2147	-1.1	0.684	26
419.5	24.0	-17.7	0.8199	0.6036	0.2163	-1.1	0.713	31
404.5	25.0	-20.3	0.8176	0.6005	0.2170	-1.9	0.605	32
389.7	26.0	-22.7	0.8113	0.5865	0.2248	-2.8	0.518	33
375.0	27.0	-24.7	0.8007	0.5658	0.2348	-2.7	0.462	33
360.1	28.0	-26.6	0.7924	0.5490	0.2434	-0.8	0.391	32
346.1	29.0	-28.9	0.7881	0.5473	0.2407	1.4	0.314	30
332.9	30.0	-31.2	0.7899	0.5545	0.2314	2.7	0.261	30
320.0	31.0	-33.3	0.7898	0.5652	0.2246	2.4	0.223	31
307.0	32.0	-35.2	0.7885	0.5676	0.2210	0.7	0.194	31
293.8	33.0	-37.2	0.7832	0.5634	0.2197	-1.7	0.172	31
281.4	34.0	-39.4	0.7731	0.5471	0.2259	-4.6	0.139	31
269.7	35.0	-41.3	0.7613	0.5207	0.2406	-6.4	0.121	31
258.1	36.0	-43.2	0.7553	0.4973	0.2580	-5.5	0.107	31
246.0	37.0	-45.6	0.7600	0.4915	0.2685	-3.0	0.082	31
233.9	38.0	-48.4	0.7671	0.4996	0.2675	-0.1	0.066	31
222.0	39.0	-50.9	0.7758	0.5054	0.2664	1.7		A
211.3	40.0	-53.3	0.7816	0.5213	0.2604	2.6		A
201.7	41.0	-55.5	0.7839	0.5277	0.2562	3.4		A
192.0	42.0	-57.5	0.7817	0.5318	0.2499	3.5		A
182.2	43.0	-59.3	0.7784	0.5354	0.2430	2.8		A
173.0	44.0	-60.8	0.7764	0.5378	0.2386	1.4		A
163.7	45.0	-62.4	0.7761	0.5371	0.2390	-0.5		A
154.4	46.0	-64.2	0.7750	0.5342	0.2408	-3.1		A
145.8	47.0	-66.1	0.7709	0.5254	0.2455	-6.4		A
138.0	48.0	-67.5	0.7677	0.5095	0.2582	-8.3		A
129.9	49.0	-68.8	0.7667	0.4909	0.2757	-6.8		A
122.3	50.0	-70.1	0.7657	0.4839	0.2818	-2.6		A
114.7	51.0	-71.4	0.7657	0.4870	0.2788	1.7		A
107.3	52.0	-71.4	0.7654	0.4917	0.2737	2.3		A
99.8	53.0	-70.0	0.7640	0.4950	0.2690	0.8		A
93.2	54.0	-68.1	0.7643	0.4922	0.2722	-0.8		A
87.4	55.0	-66.5	0.7655	0.4907	0.2748	-1.1		A
82.6	56.0	-65.0	0.7659	0.4907	0.2752	0.5		A
78.0	57.0	-63.6	0.7635	0.4911	0.2724	1.2		A
73.6	58.0	-62.1	0.7620	0.4908	0.2713	1.0		A
69.4	59.0	-60.6	0.7612	0.4892	0.2720	0.2		A
65.6	60.0	-59.2	0.7598	0.4880	0.2718	-0.6		A

61.8	61.0	-57.8	0.7591	0.4876	0.2715	-1.0	A
58.2	62.0	-56.9	0.7610	0.4876	0.2733	-1.8	A
55.1	63.0	-55.8	0.7616	0.4872	0.2744	-2.1	A
52.2	64.0	-54.2	0.7598	0.4843	0.2755	-1.5	A
49.2	65.0	-52.9	0.7583	0.4830	0.2759	-1.3	A
46.5	66.0	-52.4	0.7598	0.4834	0.2764	-0.7	A
44.3	67.0	-51.7	0.7605	0.4836	0.2771	0.0	A
42.5	68.0	-50.7	0.7601	0.4837	0.2763	0.1	A
40.6	69.0	-50.3	0.7628	0.4870	0.2758	-1.5	A
38.8	70.0	-49.5	0.7650	0.4881	0.2768	-7.5	A
36.9	71.0	-48.3	0.7645	0.4854	0.2792	-14.9	A
35.3	72.0	-47.1	0.7645	0.4781	0.2863	-20.7	A
34.0	73.0	-46.1	0.7651	0.4729	0.2924	-22.7	A
33.0	74.0	-44.9	0.7683	0.4723	0.2960	-22.6	A
31.9	75.0	-43.9	0.7833	0.4656	0.2983	-17.4	A
30.9	76.0	-43.2	0.8123	0.5083	0.3040	-3.4	A
29.9	77.0	-42.7	0.8412	0.5375	0.3037	7.8	A
28.8	78.0	-42.2	0.8525	0.5562	0.2963	16.6	A
27.8	79.0	-41.7	0.8588	0.5635	0.2953	10.8	A
26.7	80.0	-41.5	0.8624	0.5691	0.2933	-9.1	A
25.7	81.0	-41.3	0.8704	0.5749	0.2955	-28.0	A
24.6	82.0	-41.2	0.8804	0.5761	0.3043	-54.4	A
23.7	83.0	-41.0	0.8895	0.5751	0.3144	-67.1	A
23.0	84.0	-40.8	0.8987	0.5713	0.3274	-99.7	A

1 FILTERED RADIOMETER SONDE RUN FOR PH5 6 SEP 1973 OPUS 23								
PRESS	TIME	T-AIR	F-UP	F-DN	F-NET	COOL	Q-MIX	R-HUM
(MB)	(MIN)	(DEG C)	(LY/MIN)	(LY/MIN)	(LY/MIN)	(DEG/DA)	(GM/KG)	(PC)
951.0	0.0	62.0	1.0290	0.7249	0.3641	0.0	9.197	19
927.8	1.0	35.4	1.0571	0.7092	0.2879	4.1	12.248	34
905.6	2.0	32.3	1.0843	0.7989	0.2859	2.2	11.780	34
884.5	3.0	31.3	1.0910	0.8167	0.2743	3.6	11.063	35
864.2	4.0	29.8	1.0819	0.8255	0.2553	3.8	10.594	35
842.9	5.0	27.8	1.0688	0.8294	0.2394	2.7	9.947	35
821.3	6.0	25.7	1.0630	0.8276	0.2354	1.3	8.563	34
797.1	7.0	23.2	1.0521	0.8175	0.2346	0.9	7.329	32
771.9	8.0	20.5	1.0343	0.8014	0.2329	0.8	6.430	32
746.7	9.0	17.8	1.0122	0.7892	0.2230	0.9	5.832	34
723.0	10.0	15.2	0.9980	0.7737	0.2243	1.0	5.728	38
698.9	11.0	12.7	0.9846	0.7643	0.2203	1.1	6.046	46
675.3	12.0	10.1	0.9708	0.7580	0.2129	0.8	5.776	50
651.6	13.0	7.5	0.9572	0.7503	0.2070	-0.4	5.536	55
628.3	14.0	4.9	0.9472	0.7320	0.2153	-1.7	5.214	61
606.0	15.0	2.3	0.9355	0.7078	0.2278	-1.9	4.455	59
584.7	16.0	0.2	0.9189	0.6845	0.2345	-1.4	2.877	43
564.5	17.0	-1.8	0.9026	0.6692	0.2334	-1.4	1.609	27
545.7	18.0	-3.3	0.8911	0.6540	0.2371	-2.4	1.280	23
528.0	19.0	-3.6	0.8844	0.6351	0.2452	-3.5	1.195	22
510.0	20.0	-3.3	0.8829	0.6190	0.2638	-3.6	1.164	20
491.9	21.0	-3.4	0.8841	0.6106	0.2735	-3.0	1.185	19
474.2	22.0	-4.7	0.8886	0.6083	0.2813	-2.3	1.081	19
456.8	23.0	-6.8	0.8885	0.6020	0.2865	-1.9	0.952	19
440.2	24.0	-9.1	0.8823	0.5910	0.2913	-1.7	0.863	20
423.9	25.0	-11.7	0.8738	0.5784	0.2954	-1.7	0.732	20
407.9	26.0	-14.5	0.8701	0.5710	0.3011	-1.9	0.614	20
392.1	27.0	-16.9	0.8667	0.5611	0.3056	-2.1	0.518	20
377.2	28.0	-19.8	0.8647	0.5535	0.3112	-2.3	0.451	20
362.7	29.0	-22.3	0.8589	0.5422	0.3167	-2.2	0.332	20
348.0	30.0	-24.3	0.8542	0.5309	0.3234	-1.4	0.333	21
334.7	31.0	-25.7	0.8473	0.5207	0.3267	-0.6	0.297	21
322.1	32.0	-27.9	0.8427	0.5212	0.3225	-0.1	0.269	22
309.3	33.0	-30.0	0.8383	0.5146	0.3237	-0.2	0.236	23
296.1	34.0	-32.0	0.8328	0.5068	0.3260	0.1	0.203	23
283.8	35.0	-34.1	0.8258	0.4992	0.3265	0.8	0.175	23
272.2	36.0	-36.2	0.8160	0.4955	0.3204	1.2	0.146	23
261.1	37.0	-38.4	0.8099	0.4914	0.3185	0.5	0.122	23
249.5	38.0	-40.7	0.8053	0.4866	0.3187	-0.5	0.101	22
237.6	39.0	-43.0	0.8007	0.4794	0.3213	-1.4	0.083	23
225.6	40.0	-45.4	0.7953	0.4709	0.3244	-1.9	0.067	22
214.2	41.0	-47.9	0.7900	0.4603	0.3297	-1.9	0.054	22
203.0	42.0	-50.4	0.7858	0.4529	0.3329	-1.6		A
193.1	43.0	-52.9	0.7854	0.4500	0.3353	-1.1		A
183.9	44.0	-55.3	0.7831	0.4476	0.3395	-0.2		A
175.0	45.0	-57.3	0.7803	0.4432	0.3372	0.7		A
165.9	46.0	-59.3	0.7748	0.4411	0.3337	0.8		A
157.2	47.0	-61.3	0.7722	0.4409	0.3312	-0.4		A
148.9	48.0	-62.9	0.7697	0.4372	0.3325	-2.4		A
141.0	49.0	-64.4	0.7685	0.4281	0.3404	-3.0		A
132.9	50.0	-65.5	0.7655	0.4197	0.3458	-1.6		A
125.2	51.0	-66.7	0.7613	0.4165	0.3447	-0.2		A
117.8	52.0	-67.6	0.7559	0.4147	0.3412	-0.0		A
111.2	53.0	-68.9	0.7541	0.4102	0.3439	-1.1		A
104.7	54.0	-70.1	0.7517	0.4052	0.3464	-2.0		A
98.5	55.0	-70.5	0.7471	0.3985	0.3485	-2.1		A
92.5	56.0	-70.2	0.7418	0.3920	0.3499	-2.6		A
87.0	57.0	-69.9	0.7409	0.3876	0.3530	-3.3		A
81.7	58.0	-67.9	0.7389	0.3820	0.3569	-4.1		A
76.8	59.0	-64.6	0.7339	0.3740	0.3599	-4.6		A
72.2	60.0	-62.0	0.7302	0.3663	0.3639	-4.8		A

REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

67.7	61.0	-60.7	0.7310	0.3627	0.3683	-4.7	A
63.4	62.0	-59.6	0.7327	0.3612	0.3715	-4.3	A
59.6	63.0	-58.8	0.7313	0.3619	0.3734	-4.1	A
55.9	64.0	-58.7	0.7408	0.3647	0.3761	-5.4	A
52.4	65.0	-58.2	0.7446	0.3652	0.3794	-6.3	A
49.3	66.0	-57.3	0.7470	0.3624	0.3846	-5.2	A
46.4	67.0	-56.3	0.7468	0.3597	0.3870	-0.9	A
43.4	68.0	-55.7	0.7481	0.3623	0.3859	4.9	A
40.7	69.0	-55.4	0.7491	0.3681	0.3810	8.4	A
38.2	70.0	-54.7	0.7486	0.3727	0.3760	7.0	A
35.8	71.0	-53.6	0.7471	0.3740	0.3731	0.5	A
33.4	72.0	-52.7	0.7453	0.3745	0.3738	3.1	A
31.1	73.0	-51.5	0.7433	0.3731	0.3702	0.5	A
29.0	74.0	-49.7	0.7397	0.3685	0.3712	-1.8	A
27.2	75.0	-47.8	0.7359	0.3639	0.3720	-3.1	A
25.4	76.0	-46.6	0.7344	0.3615	0.3728	-4.1	A
23.6	77.0	-46.0	0.7364	0.3621	0.3743	-5.4	A
21.8	78.0	-45.5	0.7398	0.3635	0.3763	-5.4	A
20.0	79.0	-45.1	0.7435	0.3649	0.3786	-6.5	A
18.5	80.0	-44.7	0.7449	0.3661	0.3788	-11.3	A
17.2	81.0	-44.2	0.7469	0.3650	0.3819	-20.7	A
16.0	82.0	-43.5	0.7507	0.3622	0.3884	-30.0	A
14.7	83.0	-42.7	0.7572	0.3604	0.3967	-32.4	A
13.5	84.0	-42.2	0.7645	0.3614	0.4030	-35.2	A
12.2	85.0	-41.8	0.7714	0.3618	0.4096	-32.9	A
10.9	86.0	-40.9	0.7777	0.3582	0.4194	-28.8	A
9.8	87.0	-39.6	0.7791	0.3556	0.4235	-21.1	A
8.8	88.0	-37.8	0.7773	0.3521	0.4252	-9.6	A

1 FILTERED RADIOMETER SONDE RUN FOR PHX 6 SEP 1973 OPUS 24								
PRESS	TIME	T-AIR	F-UP	F-DN	F-NET	COOL	Q-MIX	R-HUM
(MM)	(MIN)	(DEG C)	(LY/MIN)	(LY/MIN)	(LY/MIN)	(DEG/DA)	(GM/KG)	(PC)
949.6	0.0	27.6	0.7066	0.7531	-0.0465	0.0	6.422	26
922.2	1.0	26.7	0.6979	0.7353	-0.0374	-1.9	6.338	26
894.7	2.0	25.4	0.6986	0.6684	0.0103	-6.2	6.007	26
866.7	3.0	23.5	0.6939	0.6529	0.0410	-6.2	5.648	27
839.5	4.0	21.5	0.6844	0.6246	0.0598	-4.8	5.410	28
813.2	5.0	19.5	0.6765	0.5947	0.0818	-3.7	5.099	29
787.1	6.0	17.3	0.6659	0.5674	0.0985	-2.6	4.997	31
762.1	7.0	14.9	0.6519	0.5484	0.1035	-1.7	5.199	37
736.4	8.0	12.1	0.6377	0.5325	0.1052	-2.0	4.376	36
710.9	9.0	9.3	0.6263	0.5108	0.1155	-3.1	3.432	33
685.3	10.0	6.7	0.6208	0.4841	0.1367	-3.5	3.207	36
660.3	11.0	4.1	0.6147	0.4615	0.1541	-2.8	2.881	36
634.7	12.0	1.3	0.6040	0.4423	0.1618	-1.2	2.436	37
610.5	13.0	-1.7	0.5924	0.4290	0.1634	0.8	2.198	39
587.7	14.0	-4.8	0.5844	0.4263	0.1580	2.7	1.239	27
565.7	15.0	-7.7	0.5753	0.4362	0.1391	3.3	0.873	23
544.6	16.0	-9.9	0.5691	0.4476	0.1215	1.6	0.711	21
524.5	17.0	-11.6	0.5660	0.4450	0.1210	-2.1	0.654	21
505.2	18.0	-13.3	0.5657	0.4261	0.1396	-5.2	0.595	22
486.2	19.0	-15.2	0.5645	0.3989	0.1656	-5.8	0.530	22
467.7	20.0	-17.4	0.5614	0.3780	0.1834	-4.7	0.443	21
448.9	21.0	-19.7	0.5539	0.3614	0.1925	-3.8	0.382	21
431.9	22.0	-21.9	0.5463	0.3421	0.2007	-3.7	0.325	21
416.1	23.0	-24.2	0.5426	0.3298	0.2128	-4.3	0.281	21
400.2	24.0	-26.5	0.5380	0.3123	0.2256	-4.3	0.240	22
383.1	25.0	-28.7	0.5342	0.2948	0.2393	-3.5	0.212	22
367.1	26.0	-30.9	0.5282	0.2817	0.2466	-2.5	0.175	22
351.6	27.0	-32.9	0.5213	0.2709	0.2504	-2.0	0.151	22
337.8	28.0	-35.0	0.5173	0.2633	0.2540	-2.1	0.131	22
325.5	29.0	-37.2	0.5169	0.2566	0.2603	-2.5	0.113	23
314.1	30.0	-38.9	0.5146	0.2489	0.2656	-2.7	0.095	22
302.1	31.0	-40.4	0.5089	0.2394	0.2705	-2.7	0.086	23
289.7	32.0	-41.9	0.5018	0.2253	0.2765	-2.9	0.076	23
277.4	33.0	-43.4	0.4964	0.2134	0.2830	-3.0	0.069	23
265.8	34.0	-44.9	0.4915	0.2019	0.2896	-3.1	0.060	22
254.9	35.0	-46.4	0.4862	0.1924	0.2939	-3.8	0.054	23
244.3	36.0	-48.0	0.4821	0.1813	0.3008	-4.6	0.050	23
233.6	37.0	-49.6	0.4800	0.1679	0.3120	-5.4	0.043	24
223.4	38.0	-51.3	0.4787	0.1567	0.3220	-6.0		A
213.7	39.0	-52.9	0.4766	0.1459	0.3307	-6.3		A
205.1	40.0	-54.6	0.4755	0.1336	0.3419	-6.9		A
197.3	41.0	-56.4	0.4728	0.1211	0.3517	-6.6		A
189.1	42.0	-58.2	0.4698	0.1094	0.3604	-6.4		A
181.1	43.0	-59.9	0.4661	0.0994	0.3677	-5.5		A
173.2	44.0	-61.4	0.4630	0.0860	0.3770	-3.8		A
166.5	45.0	-63.0	0.4580	0.0784	0.3796	-1.2		A
158.4	46.0	-64.8	0.4533	0.0742	0.3791	1.6		A
150.4	47.0	-66.4	0.4497	0.0757	0.3740	3.2		A
143.1	48.0	-67.7	0.4464	0.0774	0.3690	3.6		A
136.6	49.0	-68.7	0.4435	0.0787	0.3648	2.5		A
130.5	50.0	-69.7	0.4420	0.0798	0.3622	-0.5		A
124.7	51.0	-70.5	0.4411	0.0772	0.3639	-3.1		A
119.0	52.0	-71.5	0.4429	0.0709	0.3720	-3.7		A
113.3	53.0	-72.5	0.4431	0.0676	0.3753	-0.1		A
107.4	54.0	-73.4	0.4434	0.0654	0.3740	4.7		A
101.4	55.0	-73.8	0.4398	0.0762	0.3636	7.5		A
95.9	56.0	-74.2	0.4381	0.0835	0.3546	8.6		A
92.2	57.0	-74.6	0.4390	0.0885	0.3505	7.8		A
88.7	58.0	-74.9	0.4423	0.0960	0.3463	6.8		A
85.0	59.0	-75.0	0.4477	0.1059	0.3418	4.6		A
81.3	60.0	-74.7	0.4505	0.1128	0.3378	3.4		A

77.5	61.0	-74.4	0.4543	0.1137	0.3467	4.0	A
73.3	62.0	-74.1	0.4554	0.1199	0.3355	5.1	A
69.0	63.0	-73.9	0.4562	0.1269	0.3293	5.0	A
64.7	64.0	-73.5	0.4549	0.1291	0.3259	3.2	A
60.1	65.0	-73.4	0.4589	0.1319	0.3270	2.0	A
56.3	66.0	-72.9	0.4613	0.1362	0.3251	3.1	A
53.8	67.0	-72.3	0.4630	0.1402	0.3229	5.9	A
51.9	68.0	-71.8	0.4621	0.1427	0.3194	7.9	A
50.3	69.0	-71.6	0.4636	0.1459	0.3177	10.5	A
48.9	70.0	-71.2	0.4653	0.1498	0.3155	11.3	A
46.7	71.0	-70.7	0.4660	0.1563	0.3097	11.0	A
43.2	72.0	-70.4	0.4668	0.1636	0.3032	11.3	A
40.3	73.0	-69.9	0.4675	0.1680	0.2995	12.7	A
38.7	74.0	-69.3	0.4679	0.1733	0.2946	12.9	A
37.0	75.0	-68.7	0.4674	0.1792	0.2881	8.8	A
35.3	76.0	-68.4	0.4697	0.1815	0.2881	2.5	A
33.7	77.0	-68.1	0.4736	0.1829	0.2917	2.3	A
32.0	78.0	-67.7	0.4763	0.1865	0.2898	9.1	A
30.2	79.0	-67.3	0.4751	0.1911	0.2839	15.6	A
28.9	80.0	-67.0	0.4728	0.1937	0.2791	16.0	A
28.1	81.0	-66.6	0.4713	0.1951	0.2761	6.9	A
26.7	82.0	-66.4	0.4721	0.1947	0.2773	5.8	A
25.3	83.0	-66.0	0.4727	0.1949	0.2777	12.5	A
23.9	84.0	-65.8	0.4711	0.1992	0.2719	15.7	A
23.0	85.0	-65.4	0.4673	0.2022	0.2651	11.3	A
22.0	86.0	-65.5	0.4692	0.2016	0.2676	3.5	A
21.0	87.0	-65.5	0.4729	0.2026	0.2703	12.5	A
20.0	88.0	-65.4	0.4764	0.2101	0.2663	37.6	A
19.0	89.0	-65.0	0.4775	0.2223	0.2551	51.9	A
18.0	90.0	-64.8	0.4797	0.2366	0.2432	39.8	A
17.0	91.0	-64.7	0.4827	0.2449	0.2377	9.3	A
16.0	92.0	-64.6	0.4872	0.2461	0.2412	-16.0	A
15.0	93.0	-64.4	0.4906	0.2424	0.2482	-22.5	A
14.0	94.0	-64.2	0.4930	0.2415	0.2515	-16.5	A
13.0	95.0	-64.1	0.4968	0.2451	0.2517	-4.5	A
12.2	96.0	-64.0	0.5014	0.2485	0.2529	-3.2	A
11.4	97.0	-64.0	0.5013	0.2503	0.2510	-13.0	A
10.6	98.0	-63.9	0.5030	0.2488	0.2542	-32.5	A
9.7	99.0	-63.8	0.5050	0.2449	0.2601	-50.3	A
8.9	100.0	-63.8	0.5098	0.2386	0.2713	-47.1	A
8.1	101.0	-64.1	0.5123	0.2344	0.2779	-16.4	A
7.3	102.0	-64.3	0.5146	0.2365	0.2781	25.1	A
6.5	103.0	-64.4	0.5162	0.2481	0.2681	54.6	A
5.6	104.0	-64.3	0.5172	0.2583	0.2589	67.2	A
4.8	105.0	-64.1	0.5179	0.2624	0.2494	51.2	A
3.9	106.0	-63.8	0.5186	0.2780	0.2406	28.5	A
3.3	107.0	-63.6	0.5226	0.2805	0.2420	-0.3	A
3.0	108.0	-63.4	0.5257	0.2796	0.2461	-17.0	A
3.0	109.0	-63.3	0.5269	0.2800	0.2468	90.7	A
2.9	110.0	-63.1	0.5262	0.2845	0.2417	252.7	A
2.8	111.0	-63.1	0.5250	0.2885	0.2365	302.4	A
2.7	112.0	-63.0	0.5229	0.2931	0.2298	396.7	A

ORIGINAL PAGE IS
OF POOR QUALITY

1 FILTERED RADIOMETER SONDE RUN FOR PH5 7 SEP 1973 OPUS 25								
PRESS	TIME	T-AIR	F-UP	F-ON	F-NET	COOL	Q-MIX	R-HUM
(MB)	(MIN)	(C-G C)	(LY/MIN)	(LY/MIN)	(LY/MIN)	(DEG/DA)	(GM/KG)	(PC)
952.7	0.0	39.0	0.7742	0.6021	0.1721	0.0	12.846	35
925.0	1.0	30.4	0.7948	0.6307	0.1581	3.0	9.485	35
897.5	2.0	27.7	0.7983	0.6326	0.1657	-1.2	9.645	36
869.4	3.0	27.1	0.8006	0.6247	0.1760	-1.5	9.751	37
843.0	4.0	25.5	0.8017	0.6179	0.1839	-1.4	8.010	33
816.0	5.0	23.4	0.7992	0.6121	0.1872	-1.1	7.884	35
790.3	6.0	21.0	0.7944	0.6033	0.1911	-1.0	7.019	36
765.7	7.0	18.6	0.7906	0.5943	0.1964	-1.1	6.495	37
742.3	8.0	16.4	0.7834	0.5832	0.2002	-1.2	6.160	39
718.7	9.0	13.9	0.7749	0.5703	0.2046	-1.5	5.600	40
695.1	10.0	11.1	0.7682	0.5569	0.2113	-2.2	5.552	46
672.3	11.0	8.4	0.7626	0.5422	0.2205	-3.0	5.059	49
651.0	12.0	6.0	0.7564	0.5205	0.2359	-3.3	4.847	53
629.7	13.0	4.9	0.7471	0.4986	0.2485	-3.0	2.986	35
606.8	14.0	4.2	0.7393	0.4815	0.2578	-2.8	2.333	26
584.8	15.0	3.3	0.7352	0.4690	0.2662	-2.9	2.108	26
564.5	16.0	1.3	0.7349	0.4558	0.2791	-2.7	1.943	26
545.0	17.0	-1.0	0.7338	0.4441	0.2898	-2.1	1.673	26
525.2	18.0	-3.5	0.7323	0.4393	0.2930	-1.6	1.479	26
505.8	19.0	-5.8	0.7280	0.4335	0.2946	-1.6	1.266	26
487.1	20.0	-8.0	0.7255	0.4226	0.3028	-1.8	1.135	26
469.1	21.0	-10.2	0.7233	0.4129	0.3104	-1.8	1.039	27
451.8	22.0	-12.7	0.7192	0.4057	0.3135	-1.6	0.869	27
435.3	23.0	-14.6	0.7129	0.3959	0.3169	-1.7	0.753	27
418.7	24.0	-15.9	0.7068	0.3837	0.3231	-2.0	0.721	27
401.9	25.0	-17.7	0.7053	0.3751	0.3302	-2.1	0.646	26
385.4	26.0	-20.1	0.7053	0.3701	0.3352	-1.7	0.496	25
369.5	27.0	-22.4	0.7050	0.3642	0.3408	-1.2	0.446	25
354.4	28.0	-24.4	0.7035	0.3625	0.3410	-1.0	0.387	25
339.7	29.0	-26.8	0.7036	0.3611	0.3435	-0.6	0.331	26
326.3	30.0	-29.1	0.7017	0.3549	0.3469	-0.2	0.286	27
312.8	31.0	-30.9	0.6978	0.3529	0.3449	0.3	0.252	27
298.7	32.0	-32.6	0.6934	0.3507	0.3427	-0.1	0.233	27
284.8	33.0	-34.6	0.6886	0.3460	0.3426	-1.2	0.199	28
271.2	34.0	-37.1	0.6871	0.3374	0.3497	-2.2	0.166	28
258.6	35.0	-39.7	0.6863	0.3312	0.3551	-2.5	0.131	28
245.6	36.0	-42.4	0.6870	0.3260	0.3610	-1.8	0.107	28
233.2	37.0	-44.9	0.6864	0.3219	0.3645	-0.7	0.085	28
221.0	38.0	-47.4	0.6849	0.3207	0.3642	0.2	0.069	28
210.3	39.0	-49.9	0.6828	0.3223	0.3606	0.7	0.055	28
199.4	40.0	-52.7	0.6814	0.3208	0.3607	1.0		A
188.3	41.0	-55.3	0.6791	0.3191	0.3600	1.2		A
178.3	42.0	-57.7	0.6750	0.3193	0.3557	1.5		A
169.4	43.0	-59.7	0.6715	0.3189	0.3526	1.4		A
160.3	44.0	-61.5	0.6690	0.3174	0.3516	0.5		A
151.1	45.0	-63.2	0.6660	0.3147	0.3512	-1.0		A
142.8	46.0	-65.2	0.6639	0.3110	0.3529	-2.8		A
135.3	47.0	-66.8	0.6643	0.3047	0.3597	-3.4		A
127.7	48.0	-67.8	0.6645	0.2983	0.3663	-2.5		A
120.3	49.0	-69.3	0.6674	0.3007	0.3667	-1.3		A
112.5	50.0	-70.6	0.6698	0.3043	0.3655	-0.4		A
105.7	51.0	-71.6	0.6745	0.3062	0.3682	-0.2		A
99.5	52.0	-72.3	0.6769	0.3088	0.3682	0.1		A
93.7	53.0	-72.7	0.6786	0.3121	0.3665	0.6		A
87.7	54.0	-71.7	0.6786	0.3129	0.3657	-0.6		A
82.4	55.0	-69.8	0.6801	0.3136	0.3665	-1.1		A
77.6	56.0	-68.1	0.6872	0.3161	0.3711	0.3		A
73.0	57.0	-66.4	0.6850	0.3204	0.3686	4.2		A
68.7	58.0	-64.9	0.6869	0.3233	0.3636	5.2		A
64.5	59.0	-63.2	0.6800	0.3258	0.3543	3.3		A
60.5	60.0	-61.5	0.6846	0.3254	0.3593	0.8		A

56.9	61.0	-60.5	0.6876	0.3283	0.3593	-0.6	A
53.6	62.1	-60.0	0.6912	0.3327	0.3585	2.4	A
50.3	63.0	-60.0	0.6954	0.3389	0.3565	3.2	A
47.3	64.0	-60.2	0.6976	0.3438	0.3538	1.1	A
44.5	65.0	-59.7	0.6969	0.3438	0.3532	-5.2	A
41.8	66.0	-58.5	0.6968	0.3394	0.3574	-12.9	A
39.0	67.0	-57.4	0.7021	0.3352	0.3670	-17.0	A
36.6	68.0	-56.1	0.7133	0.3369	0.3764	-12.1	A
34.7	69.0	-54.5	0.7230	0.3434	0.3796	-2.5	A
33.1	70.0	-52.9	0.7272	0.3538	0.3735	2.8	A
31.4	71.0	-51.5	0.7323	0.3599	0.3725	-0.2	A
29.7	72.0	-50.1	0.7386	0.3626	0.3760	-6.7	A
28.0	73.0	-49.2	0.7421	0.3634	0.3787	-6.6	A
26.2	74.0	-48.7	0.7461	0.3660	0.3801	-1.2	A
24.6	75.0	-48.4	0.7498	0.3698	0.3800	5.1	A
23.2	76.0	-47.6	0.7494	0.3724	0.3770	9.9	A
22.0	77.0	-46.8	0.7447	0.3710	0.3737	9.9	A
20.8	78.0	-46.4	0.7409	0.3690	0.3719	4.1	A
19.6	79.0	-46.7	0.7438	0.3715	0.3723	-4.2	A
18.4	80.0	-47.6	0.7528	0.3792	0.3736	-9.2	A
17.4	81.0	-47.9	0.7633	0.3863	0.3770	-11.6	A
16.3	82.0	-47.4	0.7692	0.3910	0.3782	-7.5	A
15.4	83.0	-46.2	0.7714	0.3909	0.3804	1.3	A
14.5	84.0	-44.8	0.7697	0.3914	0.3783	12.7	A
13.5	85.0	-43.6	0.7691	0.3931	0.3760	23.8	A
12.5	86.0	-42.9	0.7667	0.3968	0.3699	26.4	A
11.8	87.0	-42.0	0.7629	0.3970	0.3659	21.3	A
11.2	88.0	-40.5	0.7595	0.3948	0.3647	-0.2	A
10.5	89.0	-39.6	0.7616	0.3962	0.3654	-20.7	A
9.9	90.0	-39.3	0.7723	0.4019	0.3703	-21.7	A
9.2	91.0	-39.6	0.7846	0.4100	0.3745	-9.9	A
8.6	92.0	-40.0	0.7914	0.4193	0.3721	0.7	A
8.0	93.0	-40.5	0.7990	0.4292	0.3698	-6.1	A
7.3	94.0	-40.2	0.8116	0.4392	0.3724	-32.6	A
6.7	95.0	-39.6	0.8274	0.4496	0.3778	-51.0	A
6.1	96.0	-38.7	0.8461	0.4602	0.3859	-79.4	A

1 FILTERED RADIONETER SENSITIVE FOR PH5 7 SEP 1973 OPUS 26								
PRESS	TIME	T-AIR	F-UP	F-DN	F-NET	COOL	Q-MIX	R-HUM
(MB)	(MIN)	(DEG C)	(LY/MIN)	(LY/MIN)	(LY/MIN)	(DEG/DA)	(GM/KG)	(PC)
951.1	0.0	61.0	1.0167	0.7525	0.2642	0.0	9.521	23
920.2	1.0	32.8	1.0365	0.7892	0.2473	3.2	13.871	40
890.3	2.0	29.7	1.0419	0.8104	0.2315	-3.5	12.105	41
861.1	3.0	27.3	1.0413	0.8212	0.2201	0.7	10.915	41
833.4	4.0	25.4	1.0440	0.8199	0.2240	-0.2	9.790	40
813.3	5.0	23.6	1.0455	0.8148	0.2337	0.0	8.960	39
786.9	6.0	21.5	1.0395	0.8104	0.2291	1.0	8.454	41
760.5	7.0	19.3	1.0225	0.8050	0.2175	1.3	7.932	43
734.6	8.0	17.0	1.0113	0.7994	0.2119	0.6	7.185	43
715.5	9.0	14.4	1.0058	0.7922	0.2157	-0.2	6.206	43
690.6	10.0	12.4	0.9899	0.7731	0.2168	-0.6	5.440	43
667.7	11.0	9.8	0.9760	0.7574	0.2185	-0.5	5.788	47
646.0	12.0	6.9	0.9666	0.7444	0.2222	-0.9	4.836	52
623.7	13.0	4.9	0.9563	0.7332	0.2231	-1.5	2.764	33
602.5	14.0	4.5	0.9441	0.7127	0.2314	-2.2	2.793	30
582.8	15.0	3.7	0.9405	0.6997	0.2408	-2.4	2.570	30
563.8	16.0	1.8	0.9423	0.6913	0.2510	-1.9	2.328	30
544.0	17.0	-0.4	0.9396	0.6859	0.2537	-1.2	2.109	30
523.9	18.0	-2.9	0.9320	0.6756	0.2565	-0.6	1.773	30
505.4	19.0	-5.4	0.9251	0.6666	0.2585	-0.9	1.544	30
488.7	20.0	-7.4	0.9132	0.6543	0.2589	-1.7	1.365	30
472.5	21.0	-9.4	0.9020	0.6359	0.2660	-2.7	1.228	31
455.4	22.0	-11.6	0.8930	0.6161	0.2769	-3.3	1.101	32
439.0	23.0	-14.0	0.8921	0.6039	0.2882	-3.0	0.941	31
423.9	24.0	-16.1	0.8932	0.5995	0.2937	-2.2	0.782	30
408.9	25.0	-17.8	0.8924	0.5946	0.2977	-1.8	0.715	30
394.2	26.0	-19.4	0.8889	0.5879	0.3069	-2.3	0.636	30
379.8	27.0	-21.2	0.8890	0.5812	0.3068	-3.1	0.565	30
366.2	28.0	-23.0	0.8903	0.5734	0.3169	-3.6	0.499	30
353.0	29.0	-24.9	0.8854	0.5686	0.3268	-2.9	0.437	30
339.7	30.0	-26.7	0.8751	0.5430	0.3321	-1.3	0.297	23
326.3	31.0	-28.5	0.8642	0.5320	0.3322	-0.3	0.268	23
312.7	32.0	-30.2	0.8576	0.5293	0.3283	-0.6	0.234	23
300.4	33.0	-32.1	0.8543	0.5225	0.3318	-2.0	0.201	23
288.7	34.0	-34.3	0.8463	0.5072	0.3391	-2.8	0.170	23
277.1	35.0	-36.6	0.8363	0.4885	0.3479	-2.0	0.141	23
264.9	36.0	-38.9	0.8293	0.4808	0.3486	-0.4	0.120	23
253.3	37.0	-41.1	0.8299	0.4830	0.3468	1.5	0.098	23
241.6	38.0	-43.5	0.8334	0.4912	0.3432	1.8	0.083	24
230.3	39.0	-45.5	0.8287	0.4932	0.3355	0.2	0.069	24
219.9	40.0	-47.5	0.8203	0.4833	0.3370	-3.2	0.059	24
211.2	41.0	-49.5	0.8102	0.4616	0.3465	-5.7	0.050	24
202.8	42.0	-51.6	0.8026	0.4394	0.3632	-4.7		A
193.9	43.0	-53.7	0.7959	0.4331	0.3658	-2.4		A
184.1	44.0	-55.9	0.7963	0.4322	0.3641	-1.5		A
173.9	45.0	-58.2	0.7937	0.4266	0.3671	-1.5		A
164.2	46.0	-60.2	0.7919	0.4168	0.3751	-0.1		A
154.9	47.0	-61.8	0.7864	0.4135	0.3730	2.4		A
145.8	48.0	-63.4	0.7806	0.4184	0.3622	3.3		A
137.3	49.0	-65.3	0.7762	0.4217	0.3545	2.0		A
129.8	50.0	-67.2	0.7738	0.4138	0.3599	0.7		A
123.0	51.0	-69.1	0.7708	0.4100	0.3608	0.6		A
116.2	52.0	-71.0	0.7661	0.4115	0.3547	0.7		A
108.3	53.0	-72.3	0.7658	0.4121	0.3538	-1.2		A
101.0	54.0	-72.7	0.7700	0.4105	0.3593	-3.7		A
94.8	55.0	-71.5	0.7738	0.4079	0.3659	-5.2		A
89.7	56.0	-69.4	0.7750	0.4053	0.3697	-6.0		A
84.4	57.0	-67.4	0.7782	0.4032	0.3750	-4.9		A
79.4	58.0	-66.2	0.7843	0.4030	0.3813	-3.5		A
74.7	59.0	-64.3	0.7819	0.4005	0.3814	.4		A
70.2	60.0	-62.7	0.7809	0.3999	0.3810	6.4		A

65.9	61.0	-62.1	0.7809	0.4072	0.3738	12.1	A
61.9	62.0	-61.9	0.7860	0.4246	0.3614	14.9	A
58.3	63.0	-61.7	0.7951	0.4460	0.3491	11.8	A
55.0	64.0	-61.6	0.8024	0.4573	0.3452	3.6	A
51.8	65.0	-61.0	0.7957	0.4491	0.3460	-3.0	A
48.7	66.0	-58.8	0.7803	0.4277	0.3526	-2.0	A
45.9	67.0	-56.1	0.7711	0.4177	0.3534	4.2	A
43.1	68.0	-54.1	0.7676	0.4208	0.3468	8.3	A
40.4	69.0	-53.0	0.7687	0.4294	0.3393	3.2	A
37.8	70.0	-52.4	0.7691	0.4289	0.3403	-3.9	A
35.5	71.0	-51.9	0.7712	0.4215	0.3496	-8.5	A
33.3	72.0	-51.6	0.7728	0.4230	0.3498	-7.6	A
31.0	73.0	-51.4	0.7766	0.4254	0.3512	-2.7	A
28.6	74.0	-51.3	0.7818	0.4275	0.3543	-0.1	A
26.7	75.0	-51.1	0.7876	0.4351	0.3524	-0.2	A
25.4	76.0	-50.4	0.7982	0.4490	0.3493	-4.7	A
24.2	77.0	-49.1	0.8163	0.4624	0.3540	-1.4	A
23.1	78.0	-47.7	0.8390	0.4801	0.3589	21.2	A
21.7	79.0	-46.8	0.8571	0.5081	0.3490	44.5	A
20.5	80.0	-46.2	0.8696	0.5404	0.3292	48.4	A
19.3	81.0	-45.7	0.8779	0.5567	0.3211	23.1	A
18.1	82.0	-45.3	0.8845	0.5623	0.3222	-5.1	A
16.9	83.0	-44.9	0.8916	0.5629	0.3287	-18.2	A
15.9	84.0	-44.5	0.8994	0.5690	0.3304	-23.9	A
15.2	85.0	-43.9	0.9061	0.5730	0.3331	-37.4	A
14.4	86.0	-43.0	0.9089	0.5704	0.3386	-53.3	A
13.6	87.0	-42.0	0.9118	0.5613	0.3504	-31.1	A
12.9	88.0	-41.3	0.9152	0.5590	0.3562	28.4	A
12.2	89.0	-41.0	0.9185	0.5743	0.3441	69.6	A
11.4	90.0	-40.9	0.9190	0.5952	0.3238	41.3	A
10.6	91.0	-40.8	0.9212	0.5989	0.3223	-41.9	A
9.8	92.0	-40.7	0.9278	0.5873	0.3404	-118.2	A
9.1	93.0	-40.4	0.9349	0.5769	0.3640	-126.6	A
8.2	94.0	-40.0	0.9388	0.5575	0.3814	-102.5	A
7.4	95.0	-39.4	0.9411	0.5510	0.3901	-78.5	A
6.4	96.0	-38.8	0.9453	0.5421	0.4032	-80.1	A
6.0	96.4	-38.5	0.9471	0.5385	0.4086	-77.5	A

1 FILTERED RADIONETER SOND'S RUN FOR SLE 18 JAN 1974 OPUS 27								
PRESS	TIME	T-AIR	F-UP	F-DN	F-NLT	COOL	Q-MIX	R-HUM
(MB)	(MIN)	(DEG C)	(LY/MIN)	(LY/MIN)	(LY/MIN)	(DEG/DA)	(GM/KG)	(PC)
996.1	0.0	17.7	0.7249	0.6607	0.6642	0.0	10.014	80
974.8	1.0	18.3	0.7304	0.6325	0.6978	-9.3	9.585	66
953.9	2.0	18.4	0.7459	0.6323	0.1136	-5.0	8.153	59
933.7	3.0	17.3	0.7575	0.6296	0.1279	-3.4	7.974	60
913.4	4.0	16.8	0.7603	0.6223	0.1380	-2.9	7.445	56
892.9	5.0	16.6	0.7575	0.6130	0.1445	-1.9	6.928	52

1 FILTERED PACIMETER SOND RUN FOR SLE 18 JAN 1974 OPUS 28								
PRESS	TIME	T-AIR	F-UP	F-DN	F-NET	COOL	Q-MIX	R-HUM
(MB)	(MIN)	(DEG C)	(LY/MIN)	(LY/MIN)	(LY/MIN)	(DEG/DA)	(GM/KG)	(PC)
994.7	0.0	15.1	0.6080	0.5532	0.0549	0.0	8.939	82
967.3	1.2	16.3	0.6412	0.5880	0.0532	0.4	8.020	66
943.4	2.2	16.5	0.6504	0.5768	0.0737	-2.8	9.284	74
918.7	3.2	16.0	0.6560	0.5661	0.0899	-2.5	10.254	82
892.5	4.2	15.0	0.6533	0.5575	0.0958	-1.1	10.417	87
868.1	5.2	13.5	0.6478	0.5533	0.0944	-0.2	10.214	90
845.8	6.2	11.8	0.6400	0.5459	0.0941	-0.1	9.146	89
824.0	7.2	9.9	0.6321	0.5364	0.0957	-0.2	8.245	87
802.0	8.2	8.9	0.6218	0.5254	0.0965	-0.1	7.403	86
780.0	9.2	7.6	0.6135	0.5174	0.0962	0.0	7.538	85
757.9	10.2	5.9	0.6071	0.5115	0.0956	0.0	6.273	84
736.2	11.2	3.7	0.6039	0.5080	0.0959	0.9	5.676	83
714.8	12.2	2.7	0.5985	0.5025	0.0959	2.9	5.253	82
694.1	13.2	1.7	0.5897	0.5095	0.0803	5.1	5.221	82
673.9	14.2	0.3	0.5802	0.5286	0.0516	4.7	4.915	84
655.3	15.2	-1.3	0.5807	0.5508	0.0299	0.6	4.328	81
637.7	16.2	-2.5	0.5937	0.5497	0.0440	-5.2	3.880	78
621.5	17.2	-3.8	0.6036	0.5283	0.0753	-8.5	3.455	73
604.1	18.2	-5.8	0.6001	0.4945	0.1056	-7.3	2.599	61
585.4	19.2	-7.7	0.5911	0.4670	0.1241	-4.6	1.145	32
565.9	20.2	-9.3	0.5743	0.4425	0.1318	-2.7	0.963	28
548.3	21.2	-10.5	0.5568	0.4214	0.1354	-2.7	0.815	26
531.5	22.2	-11.8	0.5463	0.4066	0.1418	-3.3	0.732	25
515.4	23.2	-12.7	0.5523	0.3928	0.1595	-3.6	0.674	24
499.8	24.2	-14.0	0.5499	0.3842	0.1657	-2.6		M
485.2	25.2	-15.8	0.5476	0.3756	0.1720	-1.4	0.025	1
469.6	26.2	-17.6	0.5405	0.3712	0.1693	-0.7	0.064	3
453.4	27.2	-19.3	0.5390	0.3625	0.1784	0.5	0.095	5
436.1	28.2	-21.2	0.5316	0.3593	0.1723	2.2	0.022	1
421.5	29.2	-23.3	0.5213	0.3573	0.1600	4.3		M
409.1	30.2	-24.9	0.5095	0.3531	0.1474	5.0	0.024	2
398.3	31.2	-26.1	0.4886	0.3500	0.1386	4.4	0.025	2
385.8	32.2	-27.8	0.4805	0.3478	0.1327	2.7	0.019	2
373.1	33.2	-29.7	0.4723	0.3453	0.1270	1.6	0.013	2
360.0	34.2	-31.4	0.4654	0.3412	0.1241	0.9	0.019	2
346.9	35.2	-33.2	0.4603	0.3353	0.1250	1.3		M
334.2	36.2	-35.2	0.4518	0.3281	0.1237	2.5	0.024	4
321.7	37.2	-37.3	0.4370	0.3239	0.1131	3.0	0.030	6
310.5	38.2	-39.5	0.4250	0.3213	0.1038	2.6	0.043	10
299.4	39.2	-41.7	0.4190	0.3144	0.1046	1.4	0.045	14
288.3	40.2	-43.9	0.4083	0.3051	0.1032	0.1	0.048	17
277.1	41.2	-46.1	0.3947	0.2943	0.1004	-0.2	0.043	19
266.9	42.2	-48.4	0.3880	0.2834	0.1046	-1.5	0.036	20
257.0	43.2	-50.7	0.3757	0.2702	0.1055	-4.2		A
247.0	44.2	-52.9	0.3687	0.2552	0.1134	-7.3		A
236.9	45.2	-55.1	0.3723	0.2403	0.1320	-8.6		A
227.1	46.2	-57.1	0.3841	0.2308	0.1533	-7.5		A
218.0	47.2	-58.9	0.3830	0.2259	0.1571	-6.4		A
210.3	48.2	-60.1	0.3809	0.2206	0.1603	-6.2		A
202.4	49.2	-60.4	0.3849	0.2100	0.1750	-8.1		A
194.5	50.2	-60.1	0.3902	0.2029	0.1873	-8.8		A
186.8	51.2	-60.1	0.3985	0.2014	0.1971	-8.6		A
180.0	52.2	-60.6	0.4074	0.2015	0.2060	-10.0		A
172.9	53.2	-61.1	0.4155	0.1958	0.2197	-12.0		A
166.3	54.2	-60.8	0.4210	0.1853	0.2357	-11.7		A
159.6	55.2	-60.0	0.4273	0.1756	0.2518	-8.0		A
153.5	56.2	-59.8	0.4295	0.1729	0.2566	-2.1		A
147.7	57.2	-60.6	0.4263	0.1742	0.2522	1.9		A
141.9	58.2	-61.6	0.4196	0.1733	0.2463	1.9		A
136.4	59.2	-62.6	0.4191	0.1719	0.2472	-3.5		A
131.7	60.2	-62.9	0.4235	0.1730	0.2505	-8.5		A

127.1	61.2	-62.7	0.4346	0.1690	0.2655	-8.1	A
121.9	62.2	-62.5	0.4384	0.1659	0.2725	-2.1	A
117.3	63.2	-62.4	0.4313	0.1622	0.2691	7.2	A
112.7	64.2	-62.3	0.4183	0.1610	0.2573	11.6	A
108.3	65.2	-62.6	0.4071	0.1625	0.2446	10.4	A
103.9	66.2	-63.8	0.4075	0.1671	0.2404	5.5	A
100.1	67.2	-64.9	0.4102	0.1706	0.2395	0.4	A
96.1	68.2	-65.8	0.4129	0.1725	0.2404	-1.9	A
92.0	69.2	-66.0	0.4149	0.1717	0.2432	-2.7	A
88.1	70.2	-65.6	0.4148	0.1699	0.2449	-2.7	A
84.6	71.2	-64.4	0.4152	0.1691	0.2461	-4.1	A
81.3	72.2	-63.6	0.4207	0.1732	0.2475	-8.4	A
78.1	73.2	-63.6	0.4313	0.1775	0.2539	-14.6	A
75.0	74.2	-63.9	0.4394	0.1751	0.2643	-21.9	A
72.1	75.2	-64.3	0.4465	0.1698	0.2767	-31.5	A
69.3	76.2	-64.6	0.4541	0.1622	0.2919	-44.2	A
66.6	77.2	-64.8	0.4737	0.1571	0.3166	-53.4	A
64.0	78.2	-65.0	0.4992	0.1511	0.3480	-70.3	A

LSTECHR. 75/08/29.NOAA KRONOS L8.3.1 75/08/21.

15.36.29.LSTEAR(X)			
15.36.29.ACCOUNT(LPB)			
15.36.30.CHARGE(IRC,ROJ44514)			
15.36.31.COPYSDP.			
15.36.35. COPY COMPLETE.			
15.36.35.CR	1.395 KCD.	\$	1.894
15.36.35.CP	0.869 SEC.		
15.36.35.CM	0.129 BDL.	\$	0.193
15.36.35.MS	32.768 KWD.	\$	0.196
15.36.35. TOTAL =		\$	2.283
15.48.35.LQ16	0.031 KPG.	\$	1.239

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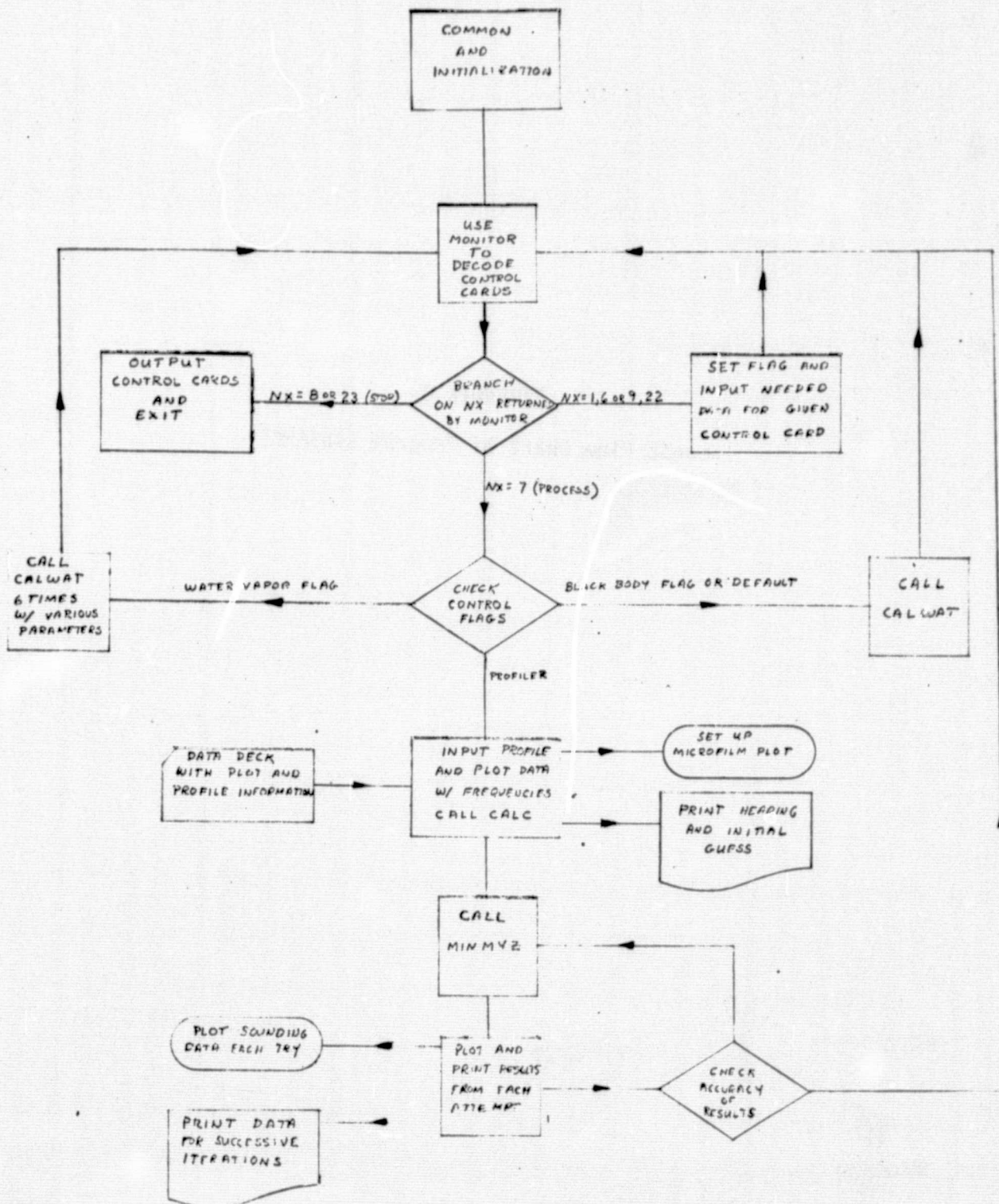
APPENDIX C

Logic Flow Chart of Program RADIANCE

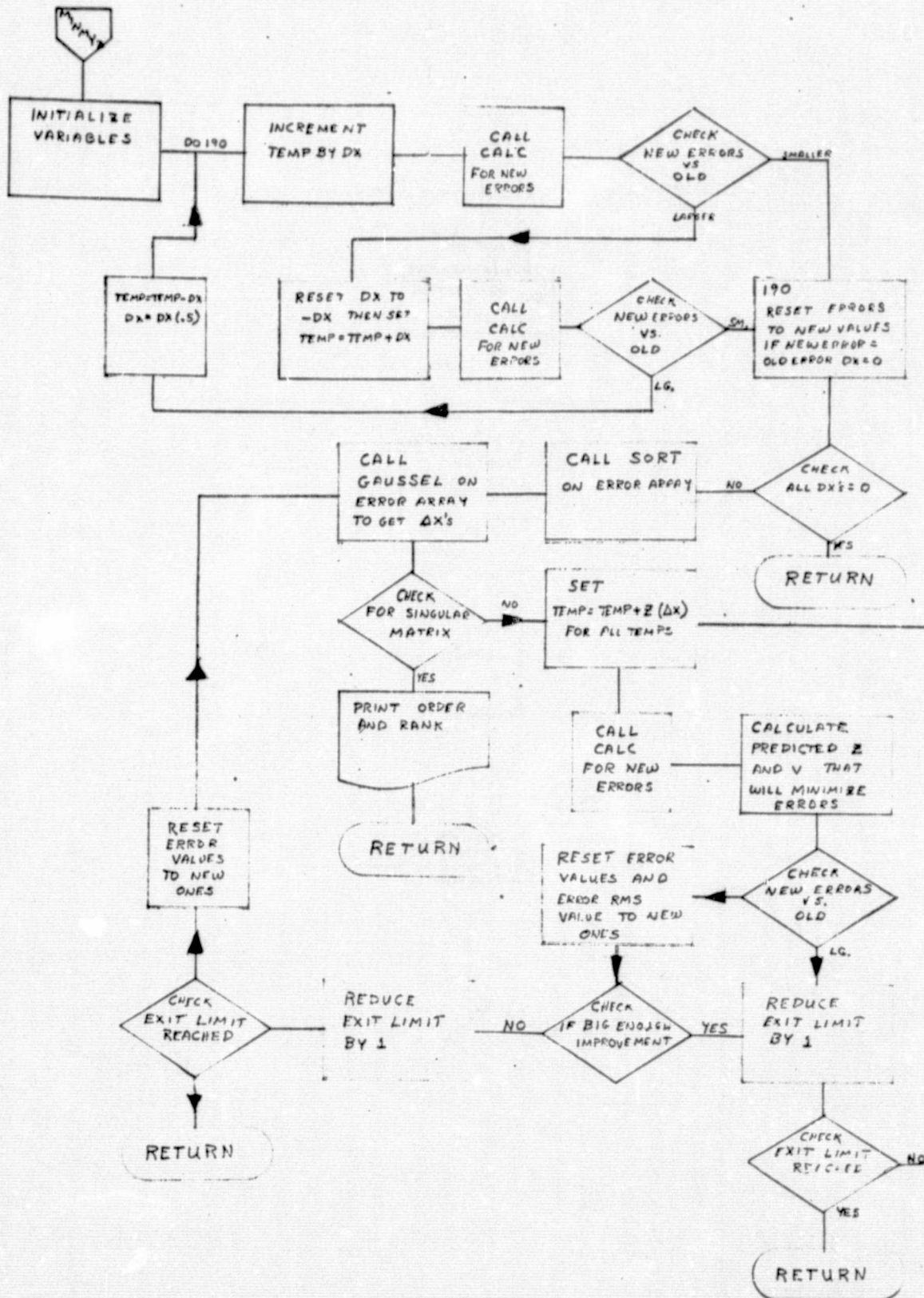
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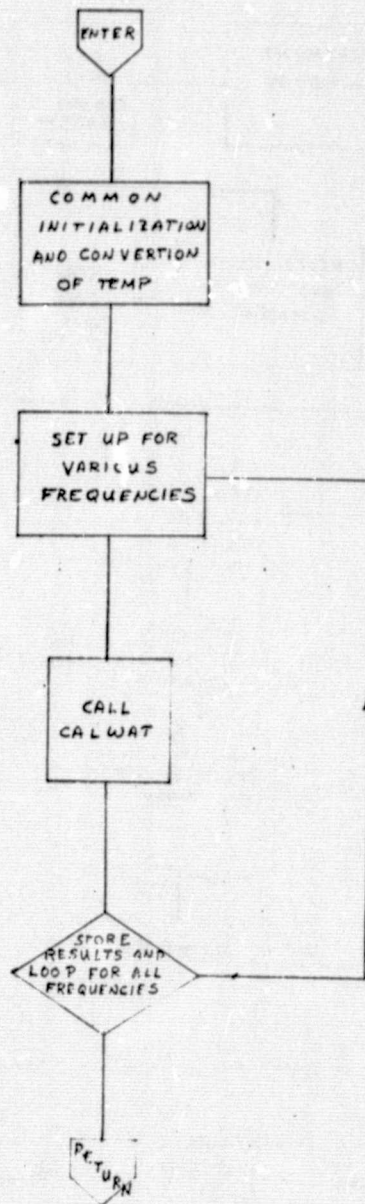
RADIANCE



Subroutine MINIMYZ

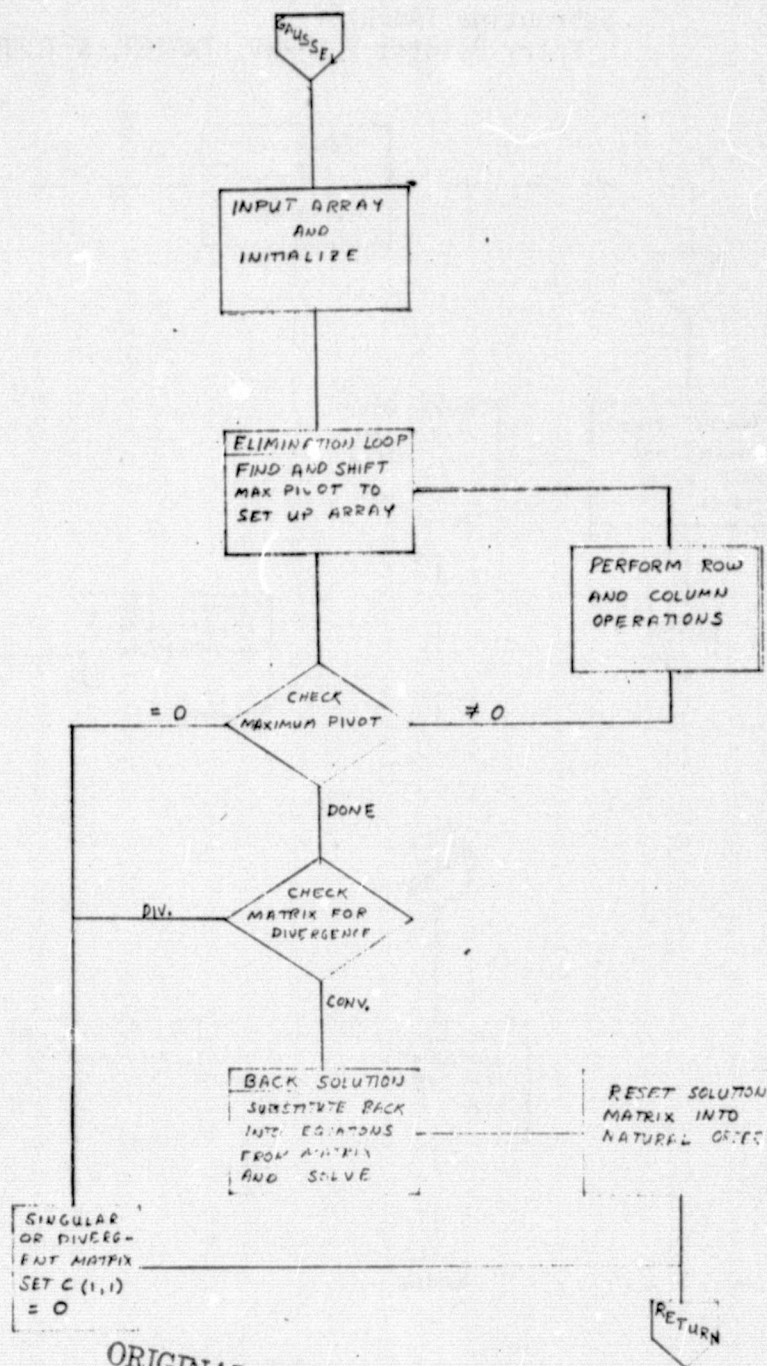


Subroutine CALC



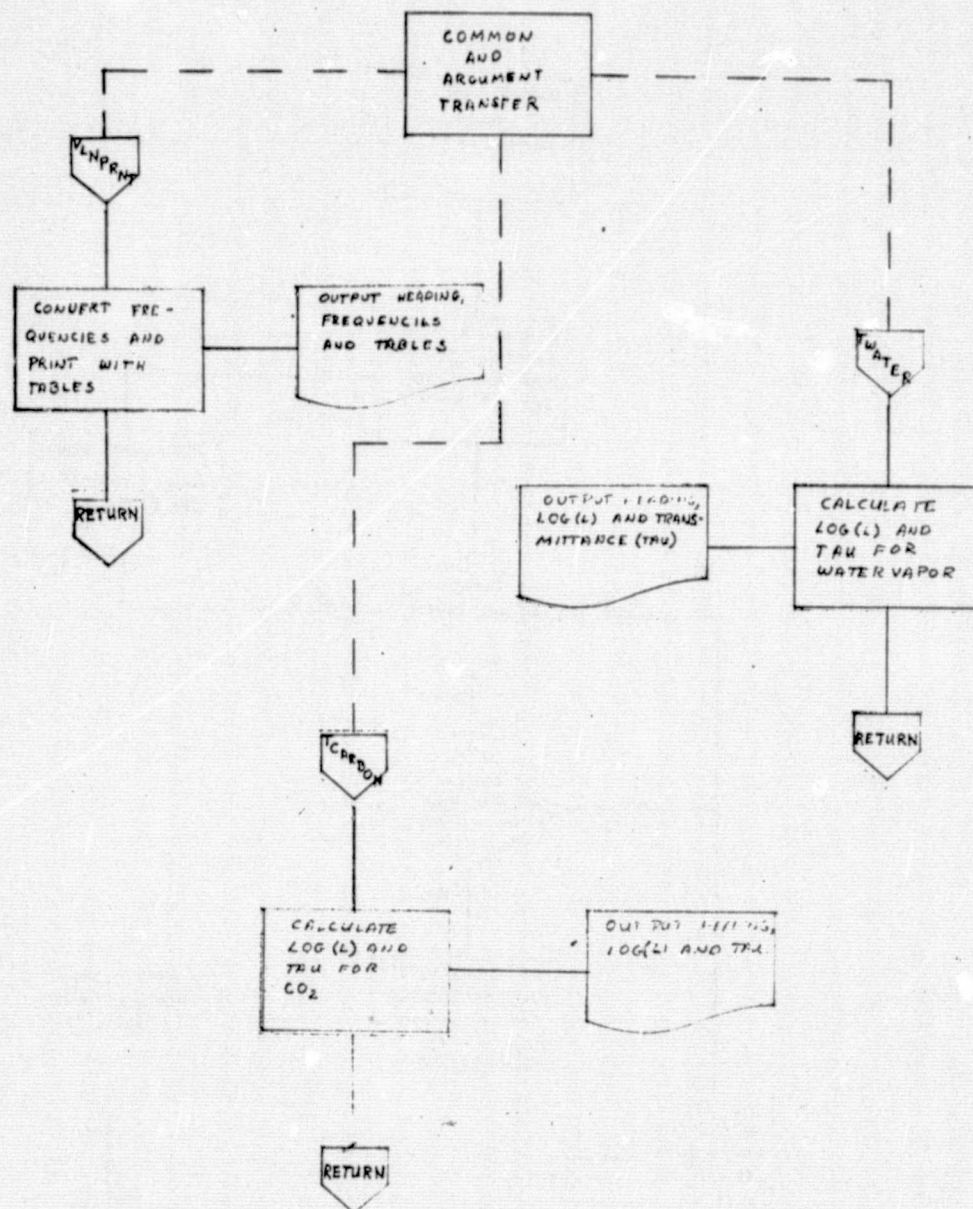
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Subroutine GAUSSEL



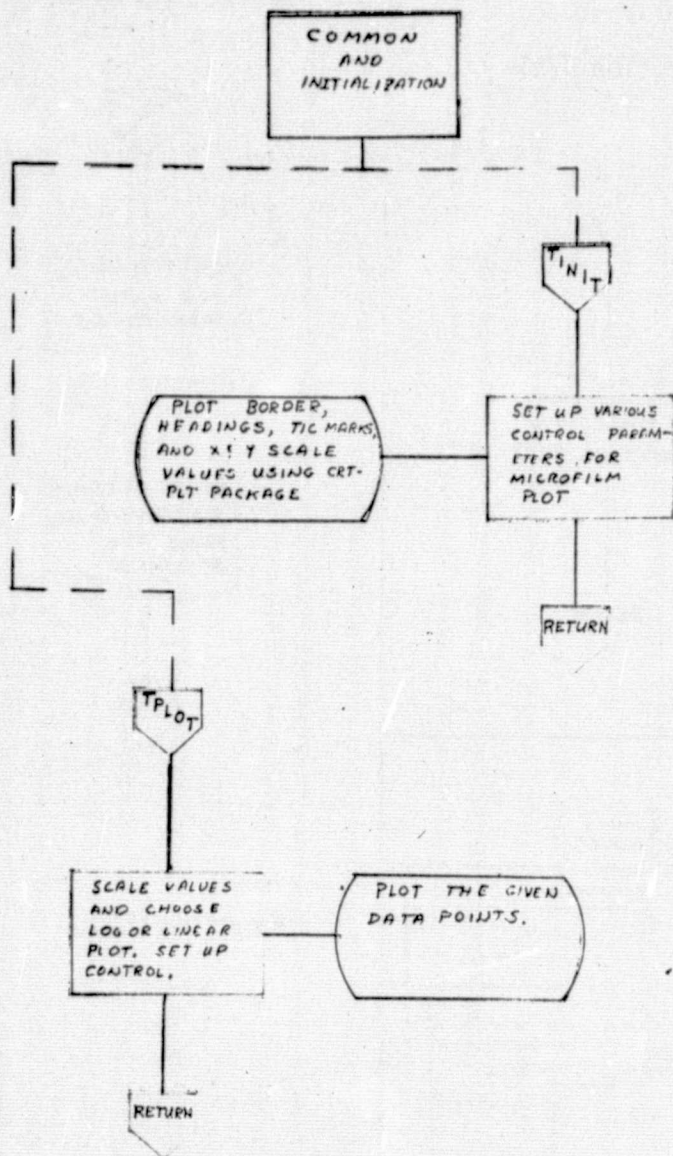
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Subroutine TABPRINT
Entry Points: VLHPRNT, TWATER, & TCARBON

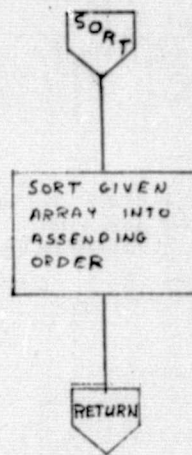


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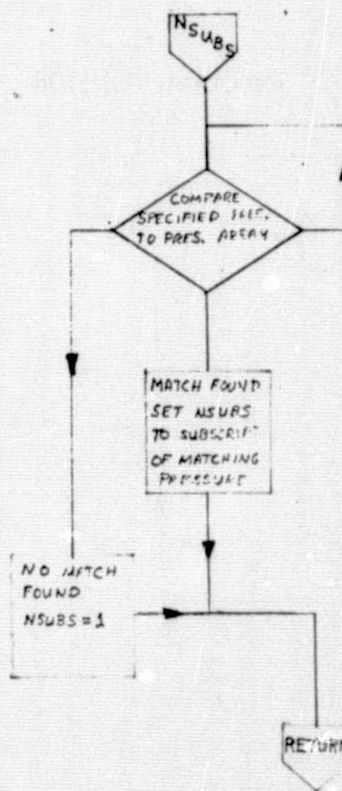
Subroutine PTPLLOT
Entry Points: TINIT & TPLOT



Subroutine SORT

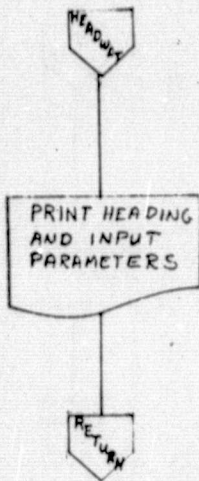


Function NSUBS

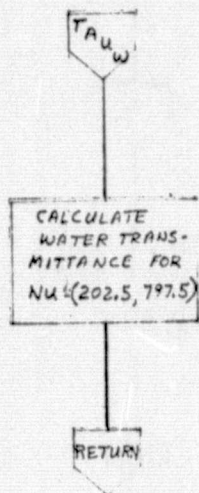


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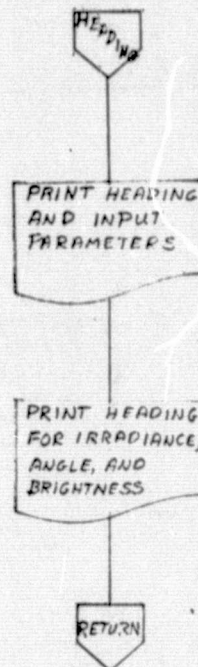
Subroutine HEADWAT



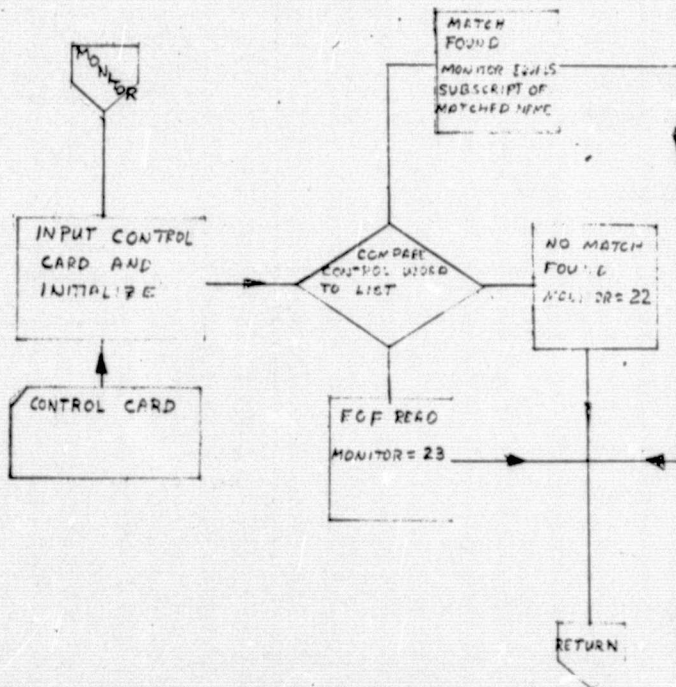
Function TAUW



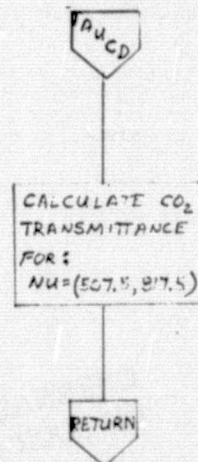
Subroutine HEADING



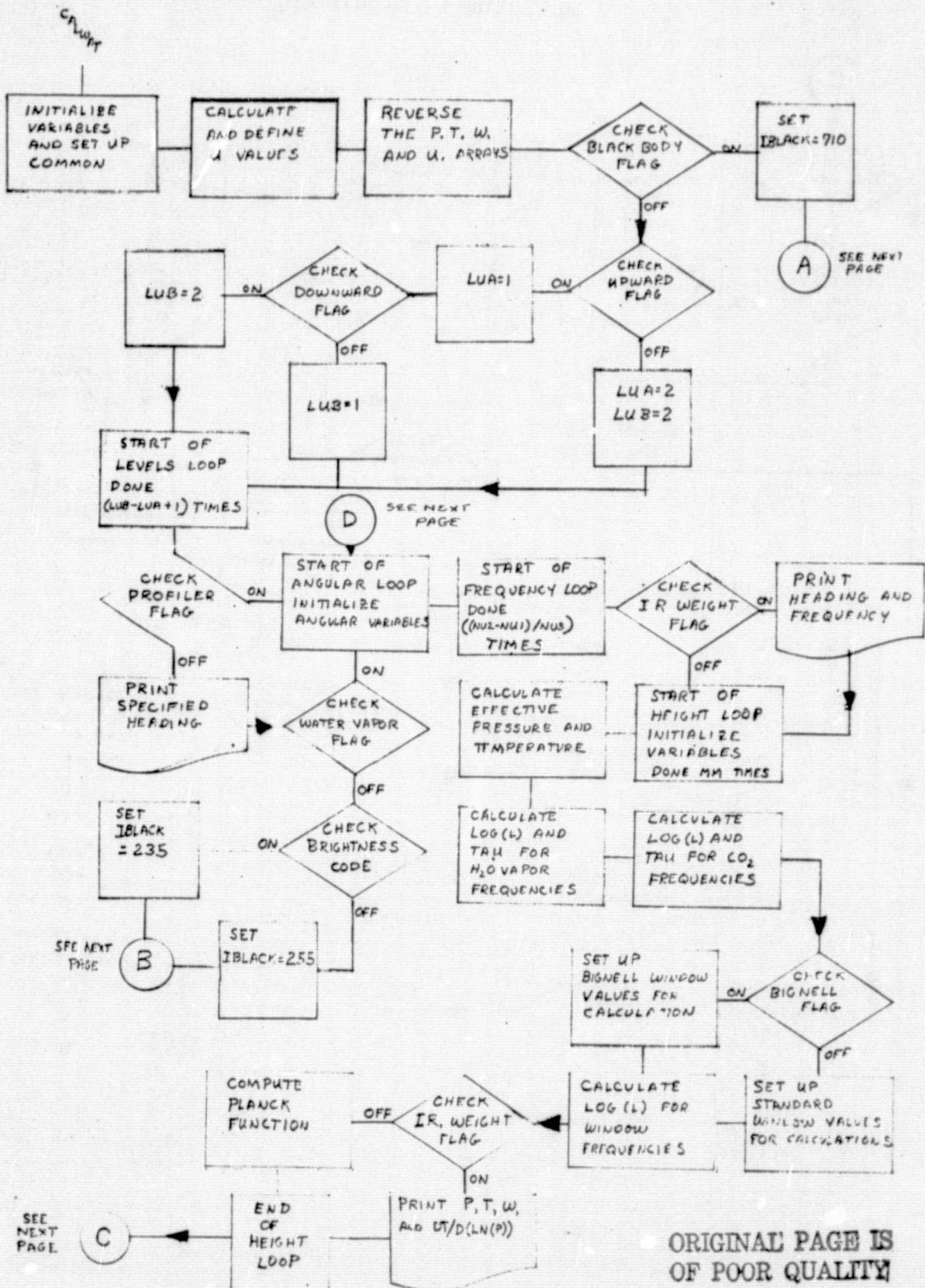
Function MONITOR



Function TAUCD

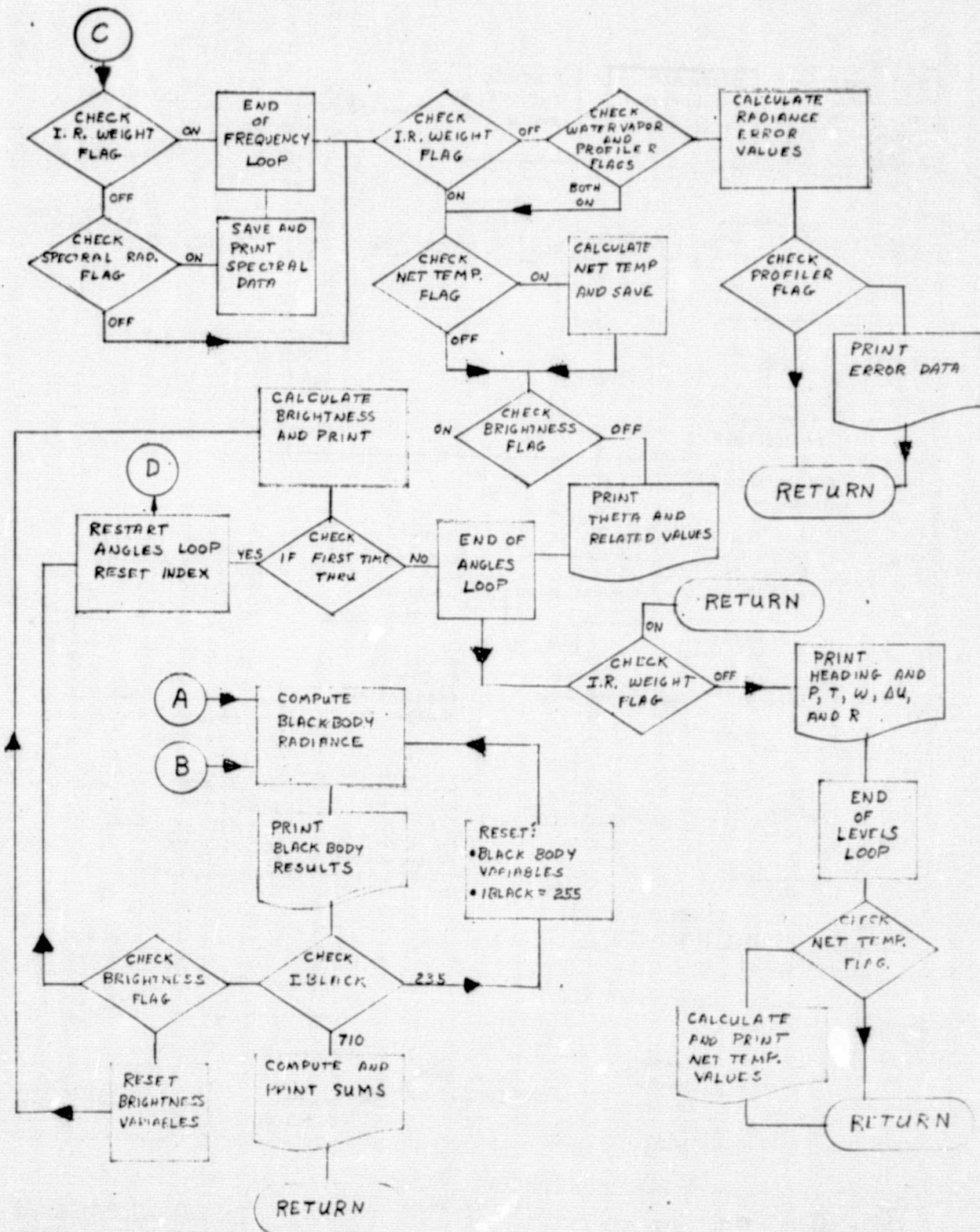


Subroutine CALWAT



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Subroutine CALWAT (cont.)



APPENDIX D
Program RADIANCE Listing

PROGRAM RADIANCE (INPUT, OUTPUT, PUNCH, TAPE10, TAPE60=INPUT)

RADIANCE PROGRAM

UPWARD OR DOWNWARD RADIANT POWER

BLACK BODY CALIBRATION

USES BILL SMITH AND/OR OLD TABLES

WATER VAPOR ADDED DEC. 28, 1973

PROFILER ADDED JANUARY, 1974

COMMON W (200, 2), PH (200, 2), T (200, 2), TO (200, 2)
COMMON DELUC (200, 2), DDELUC (200, 2), DELUNZ (200, 2)
COMMON XDELUC (200), XDELUC (200), XDELOZ (200)
COMMON SECT (3), AIII (3), W C (3), THETA (3)
COMMON INFLAG (30), NAMES (30), INPUT (10)
COMMON TTH (2), XWW (2), XPP (2), XTT (2)
COMMON IFMT (9)

DIMENSION IHU (4, 4)
DIMENSION WSS (200)

COMMON /PTW/XP (200), XT (200), XW (200), TA (200)
COMMON /HEAD /ISTA, MDATE, NDATE, WL1, TWL2, IF1, IF2, FNU1, FNU2,
1 NPAGE, DNU, NPIW, IBRIE
COMMON /XYZW /WX, WY, WZ, CW (9, 120)
COMMON /XYZ /DD, UY, DZ, CCD (9, 63)
COMMON /ALFLIR /AL (229), FLTR (229), DUMMY2
COMMON /ALCALW /ALC (229), ALW (229), ALOZ (229), OZMXR (19), OZPRS (19)
COMMON /TRANS /IWA1, TWAD, NTWA, IT (50), TCOI, TCOO, NTCO, ITC (7
14), TUZI, TOZO, NTOZ, TTOZ (41)
COMMON /XWT /X (3), WT (3), XK1 (6), XK2 (6), BBODY (75)
COMMON /PARAM /M, NANGLES, NU1, NU2, NU3, MK, LUDD, NCOSW, P, Q,
1 PI, LUN, NOZSW
COMMON /WATERP /RNOBS, FZW, H2T, VLAMB
COMMON /DATT /NCA, NCB, NWA, NWB, IPP, ISPRAD, IWINDT, NPAER, PLOW
1, PHIGH, CKNRG, ALO, ZERO, CC22, PUP, PPO, NKORS, LCON, LEVELS, IR
2WAIT, NDBRAD, LEVUP, LEVDO, TI, ID, TF, NLINES

DIMENSION NNN (6)
EQUIVALENCE (TWAI, TWII), (TWAD, TWID), (NTWA, NTWI)

DATA (NNN=0, 0, 0, -1, -1, -1)
DATA /WT = .5555555556, .8888888889, .5555555556)
DATA /X = -.7745966692, .0, .7745966692)
DATA /DEGTRAD = .017453293, /PI = 3.14159265)
DATA /ZERO = 0.)
DATA /P = 3.7413E-12, /Q = .4389)
DATA /XK1 = .18, .12, .09, .08, .07, .07, (XK2 = 25., 19., 10., 1
10., 12., 27.)
DATA /IHU=8H WATER, 8H VAPOR, 7H CARBON, 7H DIOXIDE, 8H WIN,
1 3H DOW, 8H FIL, 3H TER)
DATA /EPS = 5.E-8)
DATA /A = 357.9110836, /DO = -1.226463094E+4, /D1 = -6.4702158
142E+1, /D2 = 2.17127698E-1, /D3 = -1.317730402E-4)
IDATE(I)=8HDD/MM/YY

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```

CALL SYSTEMC(30*NNN)
NCA = 500
NCB = 810
NWA = 680
NWB = 1200
RSG = 2.87E+6 / 980.
NDATE = IDATE (XUUMMY)
1500 FORMAT (10F8.2)
NTWA = NWA - 2
NTCO = NTCO - 2
NAMES (1) = 8HFREQUENC
NAMES (2) = 8HANGLES
NAMES (3) = 8HFILTER
NAMES (4) = 8HCU2
NAMES (5) = 8HUPWARD
NAMES (6) = 8HDOWNWARD
NAMES (7) = 8HPROCESS
NAMES (8) = 8HSTOP
NAMES (9) = 8HBB CALIB
NAMES (10) = 8HPIW DATA
NAMES (11) = 8HSTATION
NAMES (12) = 8HSPECTRAL
NAMES (13) = 8HIR WEIGH
NAMES (14) = 8HRIGHTINE
NAMES (15) = 8HAEROSOL
NAMES (16) = 8HBIGNELL
NAMES (17) = 8HABLES
NAMES (18) = 8HNET TEMP
NAMES (19) = 8HZONE
NAMES (20) = 8HWATER VA
NAMES (21) = 8HPROFILER
IBRIT = 2
ISPRAC = 2
IPP = 1
NCOSW = 1
NOZSW = 1
IF1 = IF2 = 1H
NU1 = 0
NU2 = 2280
NU3 = 10
ALO = 0
AHI = 90.
LEVUP = LEVDO = 1
PUP = 1012.8
PDO = .1
WL1 = 1. / 2280.
IWL2 = 8HINFINITY
IWINDT = 1
NPAER = 2
NONAMES = 21
NCARDC = 0
IF (NONAMES .LT. 1) GO TO 465
DO 100 I = 1, NONAMES
100 INFLAG (I) = 0
465 CONTINUE
C*****
C
READ CONTROL CARDS

```

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```

C*****
145  NX = MONITOR (NUNAMES, NAMES, INPUT, 60)
      NCARDC = NCARDS + 1
      WRITE (10, 1524) INPUT
      GO TO (200, 215, 230, 240, 250, 255, 315, 265, 275, 280, 300, 310,
1 165, 170, 185, 195, 105, 14, 150, 155, 160, 305, 265), NX

```

```

C----- FREQUENCIES -----

```

```

200  INFLAG (1) = 1
      DECODE (8, 1510, INPUT (3)) N1
      DECODE (8, 1510, INPUT (4)) N2
      DECODE (8, 1510, INPUT (5)) N3
1510 FORMAT (I4)
      IF (N12.EQ. 0) NU2 = 2280
      IF (N13.EQ. 0) NU3 = 10
      FNU1 = NU1
      FNU2 = NU2
      FNU3 = NU3

```

```

C***** DETERMINE WAVELENGTHS

```

```

      WL1 = 1.E4 / FNU2
      IF (FNU1.EQ. 0) 205, 210
205  IWL2 = 8HINFINITY
      GO TO 145
210  WL2 = 1.E4 / FNU1
      ENCODE (8, 1512, IWL2) WL2
1512 FORMAT (F8.2)
      GO TO 145

```

```

C----- ANGLES -----

```

```

215  INFLAG (2) = 1
      DECODE (8, 1514, INPUT (2)) A10
      DECODE (8, 1514, INPUT (3)) A11
1514 FORMAT (F8.0)
      IF (A11.EQ. 0.) GO TO 225
      IF (A11.EQ. A10) GO TO 225
      C1 = (A11 - A10) * .5
      C2 = (A11 + A10) * .5
      CC22 = PI * (SIN (DEGTRAD * (A11 - A10))) * * 2
      DO 225 K = 1, 3
      THETA (K) = C1 * X (K) + C2
      Y = DEGTRAD * (THETA (K) - A10)
      COSY = COS (Y)
      WSC (K) = WT (K) * SIN (Y) * COSY * C1 * .10966
220  SECT (K) = 1. / COS (DEGTRAD * THETA (K))
      NANGLES = 3
      GO TO 145
225  NANGLES = 1
      WSC (1) = .10966
      THETA (1) = A10
      SECT (1) = 1. / COS (DEGTRAD * A10)
      A111 (2) = A111 (3) = 0.
      GO TO 145

```

```

C----- FILTER -----

```

```

230  INFLAG (3) = 1
      IF1 = INPUT (2)
      IF2 = INPUT (3)
      CALL RUMMYS
      IF (INPUT (4).EQ. 3HNEW) 235, 145
235  READ 1500, FLTR

```

```

CALL NLNPRNT (FLTR, IMD (1, 4))
GO TO 145
C----- COP -----
240 INFLAG (4) = 1
IF (INPUT (2) .EQ. 7HINCLUDE) NCOSW = 1
IF (INPUT (2) .EQ. 7HEXCLUDE) NCOSW = 2
GO TO 145
C----- UPWARD -----
245 INFLAG (5) = 1
IF (INPUT (2) .EQ. 5HBEGIN) DECODE (8, 1514, INPUT (3)) PUP
IF (INPUT (5) .EQ. 6HLEVELS) DECODE (8, 1510, INPUT (6)) LEVUP
IF (PUP .EQ. 0) 250, 145
250 INFLAG (5) = 0
GO TO 145
C----- DOWNWARD -----
255 INFLAG (6) = 1
IF (INPUT (2) .EQ. 5HBEGIN) DECODE (8, 1514, INPUT (3)) PDD
IF (INPUT (5) .EQ. 6HLEVELS) DECODE (8, 1510, INPUT (6)) LEVDD
IF (PDD .EQ. 0) 260, 145
260 INFLAG (6) = 0
GO TO 145
C----- PROCESS -----
315 M = M
C***** SET UP TO PRINT INPUT PARAMETERS
NLINEC=J
NPAGE = 1
IF (INFLAG (9) .EQ. 1) GO TO 330
IF (INFLAG (20) .EQ. 1) GO TO 335
IF (INFLAG (21) .EQ. 1) GO TO 360
CALL CALWAT (X1, FX1, 2)
GO TO 145
C***** BB CALIBRATE
330 CALL CALWAT (X1, FX1, 2)
GO TO 145
C***** WATER VAPOR LOOP
335 X1 = .01
DELX = .0001
CALL CALWAT (X1, FX1, 1)
CALL CALWAT (X1 + DELX, FX11, 2)
FPX1 = (FX11 - FX1) / DELX
X2 = X1 - FX1 / FPX1
340 UI = X2 - X1
IF (X2 .LE. .0000) GO TO 350
CALL CALWAT (X2, FX2, 1)
IF (ABS (FX2) - EPS) 355, 355, 345
345 CALL CALWAT (X2 + DELX, FX22, 2)
FPX2 = (FX22 - FX2) / DELX
AI = (2. * FPX2 + FPX1 - 3. * (FX2 - FX1) / DI) / DI
UI = FX2 / FPX2
X3 = X2 - UI * (1. + UI * AI / FPX2)
X1 = X2
FX1 = FX2
X2 = X3
FPX1 = FPX2
GO TO 340
350 PRINT 1530
1530 FORMAT (/ *W IS LESS THAN OR EQUAL TO .0000* //)

```

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CALL CALWAT (.001, FX1, 1)
CALL CALWAT (.0025, FX1, 1)
CALL CALWAT (.005, FX1, 1)
CALL CALWAT (.0075, FX1, 1)
CALL CALWAT (.025, FX1, 1)
CALL CALWAT (.050, FX1, 1)
GO TO 145
355 T = TA (1)
PR = VP (1)
ESLN = A + D0 / T + D1 * ALOR (T) + (D3 * T + D2) * T
ES = T0. * EXP (ESLN)
WS = .622 * ES / (PR - ES)
RH = V2 / WS * .1
PRINT 1532, RH
1532 FORMAT (///' RELATIVE HUMIDITY = ',F7.2,' %')
GO TO 145
C***** TEMPERATURE PROFILER
300 CALL PROFILE(M,NPTW,ALO,NU3)
GO TO 145
C----- STOP OR EOF -----
265 REWIN 10
PRINT 1516
1516 FORMAT ('*LIST OF INPUT CONTROL CARDS FOLLOWS*')
IF (NPARMS .LT. 1) GO TO 470 **
DO 270 I = 1, NCARDS
READ (10, 1524) INPUT
PRINT 1518, INPUT
1518 FORMAT (1X,10A8)
270 CONTINUE **
470 CONTINUE
1520 FORMAT (1H)
IF (INPUT (1) .EQ. 7HPROCESS) PRINT 1522
PRINT 1522
1522 FORMAT ('*END OF RUN*')
CALL EXIT
C----- BB CALIBRATE -----
275 INFLAG (9) = 1
INFLAG (19) = INFLAG (20) = 0
DECODE (8, 1514, INPUT (3)) TI
DECODE (8, 1514, INPUT (4)) TF
DECODE (8, 1514, INPUT (5)) T0
GO TO 145
C----- P T W DATA -----
280 INFLAG (10) = 1
ENCODE (72, 1524, IFMT) (INPUT (I), I=2, 10)
M = 0
290 READ 1524, INPUT
1524 FORMAT (10A8)
NCARDS = NCARDS + 1
WRITE (10, 1524) INPUT
IF (INPUT (1) .EQ. 7HPW END) GO TO 295
M = M + 1
ENCODE (80, 1524, INPUT) INPUT
DECODE (80, IFMT, INPUT) XP (M), XT (M), XW (M)
TA (M) = XT (M) * 273.16
T = TA (M)
PR = VP (M)

```

```

ESLN = A + D0 / T + D1 * ALOG (T) + (D3 * T + D2) * T
ES = 10. * EXP (ESLN)
WSS (M) = 622. * ES / (PR - ES)
IF (WSS (M) .LT. 0.) WSS (M) = 0.
GO TO 240
295 NPTW = M
C***** PRINT P T W DATA
PRINT 1526, (XP (I), XI (I), XW (I), WSS (I), I = 1, NPTW)
1526 FORMAT (1H1,5X,1HP,9X,1HT,9X,1HW,7X,*W CAT/(2F10.2,2F10.4))
GO TO 145
C----- STATION -----
300 INFLAG (11) = 1
ISTA = INPUT (2)
MDATE = INPUT (3)
GO TO 145
C----- SPECTRAL RADIANCE -----
310 ALO = 0.
ISPRAN = 1
GO TO 225
C----- IR WEIGHT -----
165 IPP = 2
INFLAG (13) = 1
GO TO 145
C----- BRIGHTNESS TEMPERATURE -----
170 INFLAG (14) = 1
IF (INPUT (4) .EQ. 7) INCLUDE (175, 180)
175 IBRITF = 1
GO TO 145
180 IBRITF = 2
GO TO 145
C----- AEROS L -----
185 INFLAG (15) = 1
NPAER = 1
ENCODE (32,3,INPUT (2), (INPUT (Y), I=2,5)
3 FORMAT (4AH)
DECODE (32, 1508, INPUT (2)) ABSK, PLOW, PHIGH
1508 FORMAT (E8.2,3F8.1)
IF (ABSK .EQ. 0.) GO TO 190
CKNRG = ABSK * RSG
GO TO 145
190 INFLAG (15) = 0
NPAER = 2
GO TO 145
C----- BIGNELL WINDOW -----
195 INFLAG (16) = 1
IWINDT = 2
GO TO 145
C----- TABLES -----
105 INFLAG (17) = 1
IF (INPUT (2) .NE. 4) LIST GO TO 110
CALL VLNPRNT (AL, IHU (1, 1))
CALL VLNPRNT (ALC, IHU (1, 2))
CALL VLNPRNT (ALW, IHU (1, 3))
CALL VLNPRNT (FLTR, IHU (1, 4))
CALL TWATER (A, B)
CALL TCARBON (A, B)
GO TO 145

```

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110 IF (INPUT (2) .EQ. 8HWATER VA) 115, 120
115 READ 1502, NA, NB
1502 FORMAT (2I5)
      READ 1504, (AL (NN), NN = NA, NB)
1504 FORMAT (10F8.2)
      CALL VLNPRNT (AL, IHU (1, 1))
      GO TO 145
120 IF (INPUT (2) .EQ. 8HCARBON ) 125, 130
125 READ 1502, NA, NB
      READ 1504, (ALC (NN), NN = NA, NB)
      CALL VLNPRNT (ALC, IHU (1, 2))
      GO TO 145
130 IF (INPUT (2) .EQ. 8HWINDOW) 135, 305
135 READ 1502, NA, NB
      READ 1504, (ALW (NN), NN = NA, NB)
      CALL VLNPRNT (ALW, IHU (1, 3))
      GO TO 145
C----- NET TEMPERATURE -----
140 INFLAG (18) = 1
      GO TO 145
C----- OZONE -----
150 INFLAG (19) = 1
      IF (INPUT (2) .EQ. 7HINCLUDE) NO, SW=1
      IF (INPUT (2) .EQ. 7HEXCLUDE) NO, SW=2
      GO TO 145
C----- WATER VAPOR -----
155 INFLAG (19) = INFLAG (9) = 0
      INFLAG (20) = 1
      ENCODF (24, 1, INPUT (3)) INPUT (3), INPUT (4), INPUT (5)
1   FORMAT (3A8)
      DECODF (24, 1506, INPUT (3)) VLAMB, RNOBS
1506 FORMAT (F8.0, F10.0)
      GO TO 145
C----- PROFILER -----
160 INFLAG (21) = 1
      INFLAG (9) = INFLAG (19) = INFLAG (20) = 0
      GO TO 145
C----- INCORRECT INPUT CONTROL -----
305 PRINT 1528, INPUT
1528 FORMAY (*0INCORRECT INPUT CONTROL*/IH0, I0A8)
      GO TO 145
      END

```

```
C ////////////////////////////////////////////////////////////////////  
C  
C THIS FUNCTION READS ONE CARD FROM LOGICAL UNIT LU. THE FIRST EIGHT  
C COLUMNS CONTAIN A STRING OF 8 HOLLERITH CHARACTERS. THIS STRING OF  
C CHARACTER IS COMPARED WITH THE LIST OF 8-CHARACTER STRINGS STORED IN  
C THE ARRAY NAMES. IF A MATCH IS FOUND, THE VALUE OF MONITOR IS SET  
C EQUAL TO THE SUBSCRIPT OF THE MATCHING NAME IN THE LIST. A MAXIMUM  
C OF NX NAMES WILL BE SEARCHED. IF NO MATCHING NAME IS FOUND, THE  
C VALUE OF MONITOR WILL BE SET TO X + 1. IF THE CARD WHICH WAS  
C READ IS AN END-OF-FILE CARD, THE VALUE OF MONITOR IS SET TO NX + 2.  
C IN THE ARRAY INPUT WILL BE RETURNED TEN WORDS OF HOLLERITH CHARACTERS  
C READ FROM COLUMNS 1-80 OF THE CARD. THE ARRAY INPUT MAY BE USED WITH  
C A DECODE STATEMENT.
```

CC

```

C
C . . . . . F O R M A T S . . .
C
C . . . . .

```

C

```

READ (LU, 1500) INPUT
IF (EOF(LU)) 100, 105

```

```
100 MONITOR = NX + 2
```

```
105 NAME = INPUT (1)
```

$$D_0 = 11.6 \text{ I} = 1.1 \text{ N} \bar{A}$$

110 CONTINUE

C - - - - - THERE WAS NO MATCHING NAME IN THE LIST OF NAMES.

RETURN

C - - - - - A MATCHING NAME WAS FOUND.
116 MONITOR - I

RETURN

99

SUBROUTINE CALWAT (WU, FWZ, CODE)

C

COMMON W (200, 2), PR (200, 2), T (200, 2), TO (200, 2)
COMMON DELUC(200,2), UDELU(200,2), DELUNZ(200,2)
COMMON XDELU(200), XDELUC(200), XDELOZ(200)
COMMON SECT (3), AII (3), WLC (3), THETA (3)
COMMON INFLAG (30), NAMES (30), INPUT (10)
COMMON ITB (2), XWW (2), XPP (2), XTT (2)
COMMON IFMT (9)
DIMENSION FNET (200, 2), VNET (200)

C

COMMON /PTW/XP(200),XT(200),XW(200),TA(200)
COMMON /HEAD /ISTA, MDALF, NDATE, WL1, WL2, IF1, IF2, FNU1, FNU2,
1 NPAGE, DNU, NPIW, IBRIE
COMMON /XYZW /W1, WY, WZ, CW (9, 120)
COMMON /XYZ /DX, DY, DZ, CCD (9, 63)
COMMON /ALFLIR /AL (229), FLTR (229), DIMMY2
COMMON /ALCALW /ALC (229), ALW (229), ALOZ (229), OZMXR (19), OZPRS (19)
COMMON /TRANS /TWAI, TWAD, NTWA, TT (50), TCOI, TCOO, NTCO, ITC (7
14), TOZI, TOZO, NTUZ, TIOZ (41)
COMMON /XWT /X (3), WT (3), XK1 (6), XK2 (6), BBODY (75)
COMMON /PARAM /M, NANGLES, NU1, NU2, NU3, MK, LUDD, NCOSW, P, Q,
1 PI, LUN, NOZSW
COMMON /WATERP /RNOBS, FZW, ZT, VLAMB
COMMON /DATT /NCA, NCB, NWA, NWB, IPP, ISPRAD, IWINDI, NPAER, PLOW
1, PHIGH, CKNRG, ALO, ZERO, CC22, PUP, PPO, NKORS, LCON, LEVELS, IR
2 WAIT, NBBRAD, LEVUP, LEVDO, TI, TD, TF, NLINES
COMMON /VALUE /AII
DIMENSION NNN(6)

C

EQUIVALENCE (TWAI, TWI1), (TWAD, TWID), (NTWA, NTWI)

C

DATA (NNN=0,0,0,-1,-1,-1)

C

NOZA1=970
NOZB1=1080
NOZA2=1080
NOZB2=1130
CALL CSYSTEMC(30,NNN)
GAMMA = .85
IF (INFLAG (20) .EQ. 0) GO TO 105
IF (M .LT. 1) GO TO 730
DO 100 I = 1, M
XW (I) = W0 * (XP (I) / XP (1)) * VLAMB
100 CONTINUE
730 CONTINUE
105 XWW (I) = XW (I)
XWW (2) = XW (M)
XPP (I) = XP (I)
XPP (2) = XP (M)
XTT (I) = XT (I)
XTT (2) = XT (M)
ITB (I) = TA (I)
ITB (2) = TA (M)

C*****

C DEFINE U VALUES

C*****

```

MM = M - 1
IF (MM .LT. 1) GO TO 735
DO 110 I = 1, MM
N = I + 1
AdSPP = ABS (XP (I) - XP (N))
AVPRS = (XP(I)+XP(N))*0.5
WHAR = .5 * (XW (I) + XW (N))
IF (AVPRS .LT. OZPRS(1)) GO TO 16
OZBAR = OZMXR(1)
GO TO 17
16 IF (AVPRS .GT. OZPRS(19)) GO TO 18
OZBAR = OZMXR(19)
GO TO 17
18 DO 15 JO=1,19
IF (AVPRS .LT. OZPRS(JO)) GO TO 15
OZBAR = ((AVPRS - OZPRS(JO)) * (OZMXR(JO) - OZMXR(JO-1))) / (OZPRS(JO-1) -
*OZPRS(JO)) + OZMXR(JO-1)
GO TO 17
15 CONTINUE
17 XDELO7(1) = ABSPP * OZBAR * .001024
XDELO7(1) = ABSPP * OZBAR * .001024
XDELII(1) = WBAR * ABSPP * .0010204
110 XDELUC(I) = ABSPP * .248
735 CONTINUE
C*****
C REVERSE P,T,W, AND U ARRAYS
C*****
NPTM1 = NPTW - 1
NPTP1 = NPTW + 1
DDELU (NPTW, 1) = DDELU (1, 2) = 0.
IF (NPTW .LT. 1) GO TO 740
DO 120 I = 1, NPTW
JJ = NPTP1 - I
W (I) = W (JJ + 200) = XW (JJ)
PR (I) = PR (JJ + 200) = XP (JJ)
T (I) = T (JJ + 200) = TA (JJ)
TO (I) = TO (JJ + 200) = XT (JJ)
IF (I .EQ. 1) GO TO 115
T (JJ + 200) = T (I - 1) = .5 * (T (I - 1) + T (I))
IF (I .EQ. NPTW) GO TO 120
115 JJ = NPTW - 1
DELU (I) = DELU (JJ + 200) = XDELU (JJ)
DDELU (I) = DDELU (JJ + 200) = XDDELU (JJ)
DELUO7(I) = DELUO7(JJ+200) = XDELO7(JJ)
120 CONTINUE
740 CONTINUE
125 IF (INPUT (2) .EQ. 5) SMITH = 1, 0, 135
130 ASSIGN 305 TO NSMITH
GO TO 140
135 ASSIGN 310 TO NSMITH
ASSIGN 355 TO IPTH
ASSIGN 405 TO IPTU
140 IF (INFLAG (9) .EQ. 1) 145, 140
145 GO TO 670
150 IF (INFLAG (5) .EQ. 1) 155, 170
155 LUA = 1
IF (INFLAG (6) .EQ. 1) 160, 145

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160 LUB = 2
    GO TO 175
165 LUB = 1
    GO TO 175
170 LUA = 2
    LUB = 2
175 IF (LIB .LT. LUA) GO TO 745 **
    DO 655 LUD = LUA, LUB
    LUDD = 200 * (LUD - 1)
    MKI = 1
    GO TO (180, 185), LUD
180 LEVELC = LEVUP
    MKF = NSUBS (PUP, PR (1, 1), NPTW)
    GO TO 190
185 LEVELC = LEVDO
    MKF = NSUBS (PDU, PR (1, 2), NPTW)
190 MKF = MKF
    MKL = MKF - 1
    IF (INFLAG (21) .EQ. 1) GO TO 220
    IF ((MPAGE .EQ. 1) .AND. (NLINES .EQ. 0)) 195, 215
195 IF (INFLAG (20) .EQ. 0) GO TO 200
    CALL HEADWAT (LUD)
    PRINT 1500, VLAMB
1500 FORMAT (90X, 'LAMBDA = ', F6.2)
    NLINEC = NLINES + 1
    GO TO 215
200 GO TO (210, 205), IPP
205 PRINT 1502, ALO, NDATE
1502 FORMAT (1H1, 'X', 'ANGLE = ', F5.1, '40X, 'COMPUTED ', A8)
    NLINEC = 1
    GO TO 215
210 CALL HEADING (LUD)
    NLINEC = NLINES + 1
215 IF (INFLAG (20) .EQ. 0) GO TO 225
220 MKN = 1
    MKL = MM
    GO TO 285
225 GO TO (230, 245), IBRIIE
230 ASSIGN 235 TO IBLACK
    TEMP = - 270.
    DO 240 J = 1, 75
    GO TO 605
235 BBODY (J) = SUM5
240 TEMP = TEMP + 5.
C*****
C                                     LEVELS LOOP
C*****
245 ML = 1
    MKO = 0
    MKN = MKF - 1
250 TEMP = ITB (LUD) - 273.16
    ASSIGN 255 TO IBLACK
    GO TO 685
255 GO TO (260, 265), IBRIIE
260 AII = SUM6
    UCX = 0.
    UUX = 0.

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      ASSIGN 275 TO NWRITE
      GO TO 600
265  IF (I, FLAG (18) .EQ. 0) GO TO 270
      MK = MK0 + 1
      FNET (MK, LUD) = SUM6 * PI * 1.E+4 / 699.
270  IF (INFLAG (13) .EQ. 1) GO TO 280
      PRINT 1518, ZERO, SUM6, ZERO, ZERO
275  SUM7 = SUM6 * CC22
      PRINT 1520, XPP (LUD), XTT (LUD), XWW (LUD), ZERO, SUM7
280  IF (MKL .LT. MK1) GO TO 750 **
      MK=MK1
281  MKN = MKF - MK
C*****
C                                     ANGULAR LOOP
C*****
285  K=1
286  CTT = SECT (K)
      MK1 = MKN
      MM = MKL
C*****
C                                     FREQUENCY LOOP
C*****
      SUM2 = SUM3 = SUM6 = SUM7 = 1.
      SUMTA = SUMTB = 0.
290  IF (NU2 .LT. NU1) GO TO 760 **
      DO 566 I = NU1, NU2, NU3
      FACT = 1.
      IF ((I .EQ. NU1) .OR. (I .EQ. NU2)) FACT = .5
      UNU = I
      IF (INFLAG (13) .EQ. 0) GO TO 295
      PRINT 1504, UNU
1504  FORMAT (// *OPRESSURE*, 10X, *TEMP*, 12X, *DT/D(LN(P))*, 10X, *FREQUENCY
1      = *, F4.1)
      PUNCH 1506, ISTA, MDATE, UNU
1506  FORMAT (13X, 2A8, *F4.9FREQUENCY, 1 = *, F4.0, *(1/49CM+1)*
      MK1 = MK1
295  UNU3 = UNU * * 3
      CX = UX = UUX = UCX = 0.
      XUX = XCX = 0.
      PW = TW = PC = IC = 0.
      OZX=XOZX=UOZX=0.
      POZ=TOZ=0.
      SUMTA = 0.
300  IP1 = 1.
      GO TO NSMITH, (305, 310)
305  ASSIGN 355 TO IP1H
      ASSIGN 405 TO IP1D
      IF ((UNU .GE. 202.5) .AND. (UNU .LE. 797.5)) ASSIGN 390 TO IP1H
      IF ((UNU .GE. 507.5) .AND. (UNU .LE. 817.5)) ASSIGN 440 TO IP1D
310  ITBLUD = TO (MM + 1, LUD) + 273.16
      SUMS = SUM = 0.
C*****
C                                     HEIGHT LOOP
C*****
      IF (MM .LT. MK1) GO TO 765 **
      DO 557 J = MK1, MM
      JCLUD = J + LUDU

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      AUX = AUX + UDELU (J, LUD)
      XCX = XCX + UELUC (J, LUD)
      XOZX = XOZX + UELUOZ (J, LUD)
C*****
C      CALCULATE EFFECTIVE PRESSURE AND TEMPERATURE
C*****
      DUCX = UELUC (J, LUD) * CTT
      DUUX = UDELU (J, LUD) * CTT
      DUOZX = UELUOZ (J, LUD) * CTT
      PB = .5 * (PR (J, LUD) + PR (J + 1, LUD))
315  UUX = UUX + DUUX
      PW = nW + PB * DUUX
      TW = TW + T (J, LUD) * DUUX
320  PEW = PW / UUX
325  TEW = TW / UUX
330  UCX = UCX + DUCX
      PC = nC + PB * DUCX
      TC = TC + T (J, LUD) * DUCX
335  PEC = PC / UCX
340  TEC = TC / UCX
      UOZX = UOZX + DUOZX
      POZ = POZ + PR * DUOZX
      TOZ = TOZ + T (J, LUD) * DUOZX
      PEOZ = POZ / UOZX
      TEOZ = TOZ / UOZX
      PRAT = PR * .001
      UX = UX + DUUX * (PRAT) * * GAMMA
      CX = CX + DUCX * (PRAT) * * * 6
      OZX = OZX + DUOZX * (PRAT) * * .85
345  IF (UY) 385, 385, 350
350  GO TO IPTH, (355, 390)
355  TRAT = 293.15 / T (J, LUD)
      IF (TRAT.LE.0.) GO TO 350
      A1 = ALOG10 (TRAT)
356  A2 = TRAT - 1.
C*****
C      LOG(L) FOR WATER VAPOR
C*****
      IF (UY .LE. 0.) GO TO 385
      IF (I .GT. 950) GO TO 360
      UDIF = UNU
      ACOEF = .98E-5
      GO TO 375
360  UDIF = UNU - 1595.
      IF (UNIF) 365, 370, 370
365  ACOEF = 2.4E-5
      GO TO 375
370  ACOEF = 1.75E-5
375  WW = i * .1
      IW = nW
      ALIII = AL (IW + 1) + (WW - TW) * (AL (TW + 2) - AL (IW + 1))
      AALOG = ALIII + A1 - ACOEF * A2 * UDIF * * 2
C*****
C      TAU FOR WATER VAPOR
C*****
      ULOGW = ALOG10 (UX)
      ALU = ULOGW + AALOG

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      WW = (ALU - IWA1) / IWAU
      IW = WW
      IF (IW .LT. 0) GO TO 385
      IF (IW .GT. NTWA) GO TO 380
      T2 = TT (IW + 1) + (WW - IW) * (TT (IW + 2) - TT (IW + 1))
      IF (T2 .GT. 1.) T2 = 1.
      IF (T2 .GT. 1.E-10) GO TO 395
380   IP2 = 0.
      GO TO 480
385   T2 = 1.
      GO TO 395
C----- SET UP WITH SMITH TABLES -----
390   IF (UUX .LE. 0.) GO TO 385
      WX = ALOG (UUX)
      WY = ALOG (PEW * .001)
      WZ = ALOG (TEW / 273.16)
      T2 = TAUW (UNU)
C-----
395   IP2 = T2
      GO TO (400, 430), NCOSW
400   GO TO IPTD, (405, 440)
405   IF (CV .LE. 0.) GO TO 435
      IF (I .LT. NCA) GO TO 435
      IF (I .GT. NCB) GO TO 435
C***** LOG(L) FOR CARBON DIOXIDE *****
C*****
      UDIF = UNU - 667.
      IF (UDIF) 410, 415, 415
410   ACOEF = 4.6E-4
      GO TO 420
415   ACOEF = 3.4E-4
420   WW = 1.
      IW = WW
      ALCII = ALC (IW + 1) + (WW - IW) * (ALC (IW + 2) - ALC (IW + 1))
      ALOG = ALCII + A1 - ACOEF * A2 * UDIF * * 2
C***** TAU FOR CARBON DIOXIDE *****
C*****
      ULOGC = ALOG10 (CX)
      ACLU = ULOGC + ACOEF
      WW = (ACLU - TCUI) / ICUD
      IW = WW
      IF (IW .LT. 0) GO TO 435
      IF (IW .GT. NTCU) GO TO 425
      T2C = TTC (IW + 1) + (WW - IW) * (TTC (IW + 2) - TTC (IW + 1))
      IF (T2C .GT. 1.) T2C = 1.
      IF (T2C .GT. 1.E-10) GO TO 445
425   IP2 = 0.
      GO TO 480
430   UCX = 0.
435   T2C = 1.
      GO TO 445
C----- SET UP WITH SMITH TABLES -----
440   IF (UCX .LE. 0.) GO TO 435
      UX = ALOG (UCX)
      UY = ALOG (PEC * .001)

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      OZ = ALUG (TEC / 273.16)
      T2C = TAUCD (UNU)
C-----
445  IP2 = TP2 * T2C
      GO TO (1,2),NOZSW
      1 IF(OZY.LE.0.) GO TO 3
      IF(I.I.T.NOZA1) GO TO 3
      IF(I.I.T.NOZB2) GO TO 3
      IF(I.I.T.NOZB1) GO TO 4
      IF(I.I.E.NOZA2) GO TO 5
      GO TO 3
C*****
C                                  LOG(L) FOR OZONE
C*****
      4 UDIF=INU-1043.
      IF(UDIF) 6,7,7
      5 UDIF=INU-1110.
      IF(UDIF) 8,9,9
      8 ACOEF=14.E-4
      GO TO 10
      9 ACOEF=40.E-4
      GO TO 10
      6 ACOEF=4.E-4
      GO TO 10
      7 ACOEF=14.0E-4
      10 WW=I*.1
      IW=WW
      ALOZ1=AL0Z(IW+1)+(WW-IW)*(A10Z(IW+2)-AL0Z(IW+1))
      AOZLO=ALOZ1+A1-ACOEF*A2*UDIF**2
C*****
C                                  TAU FOR OZONE
C*****
      ULOGO7=ALOG10(OZX)
      AOZLU=ULOGOZ+AOZLOG
      WW=(AOZLU-TOZI)/TOZD
      IW=WW
      IF(IW.LT.0) GO TO 3
      IF(IW.GT.NTOZ) GO TO 11
      T2OZ=T0Z(IW+1)+(WW-IW)*(TTOZ(IW+2)-TTOZ(IW+1))
      IF(T2OZ.GT.1.) T2OZ=1.
      IF(T2OZ.GT.1.E-10) GO TO 12
      11 TP2=0.
      GO TO 480
      2 UOZX=.
      3 T2OZ=.
      12 IP2=TP2*T2OZ
      GO TO (465, 450), IWINDI
C-----
C                                  BIGNELL WINDOW
C-----
450  IF (I - 700)475, 455, 455
455  IF (I - 1200)460, 475, 475
460  WW = .01 * (I - 700)
      IW = WW
      WD = WW - IW
      VALK1 = XK1 (IW + 1) + WD * (XK1 (IW + 2) - XK1 (IW + 1))
      VALK2 = XK2 (IW + 1) + WD * (XK2 (IW + 2) - XK2 (IW + 1))
      PBAR = .5 * (PR (J, LUD) + PR (J + 1, LUD))
      DELP = ABS (PR (J + 1, LUD) - PR (J, LUD))

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      TBAR = 1 (J, LUD)
      WBAR = .5E-3 * (W (J + 1, LUD) + W (J, LUD))
      TMLN = WBAR * PBAR * DELP * (VALK1 * TTR (LUD) / TBAR + VALK2 * WB
      IAR / .642) / XPP (LUD) / 980
      SUMTB = SUMTB + TMLN
      TZW = EAP ( - SUMTB)
      GO TO 480

C----- STANDARD WINDOW -----
465 IF (I .LT. NWA) GO TO 475
    IF (I .GT. NWB) GO TO 475
C*****
C      LOG(L) FOR WINDOW
C*****
    IF (UX .LE. 0.) GO TO 475
    ULOGWA = ALOG10 (UX)
    WW = T * .1
    IW = WW
    ALWII = ALW (IW + 1) + (WW - IW) * (ALW (IW + 2) - ALW (IW + 1))
    AWLU = ULOGWA + ALWII
    WW = (AWLU - TWII) / IWID
    IW = WW
    IF (IW .LT. 0) GO TO 475
    IF (IW .GT. NTWI) GO TO 470
C*****
C      TAU F.R WINDOW
C*****
    TZW = TT (IW + 1) + (WW - IW) * (TT (IW + 2) - TT (IW + 1))
    IF (TZW .GT. 1.) TZW = 1.
    IF (TZW .GT. 1.E-10) GO TO 480
470 IP2 = 0
    GO TO 480
475 TZW = 1.
480 IP2 = TP2 * TZW
    IF (J - MK1) 515, 515, 485
485 GO TO (490, 515), NPAER
490 IF (PD (J, LUD) - PL0W) 515, 495, 495
495 IF (PD (J, LUD) - PHIGH) 500, 500, 515
C----- AEROSOL CALCULATION -----
500 DELP = ABS (PR (J + 1, LUD) - PR (J, LUD))
    PBAR = .5 * (PR (J + 1, LUD) + PR (J, LUD))
    SUMTA = SUMTA + T (J, LUD) * DELP / PBAR
    IPAER = EXP ( - CKNRG * SUMTA)
    IF (IPAER - .01) 505, 505, 515
505 MM = 1 - 1
    GO TO 290
510 IP2 = TP2 * IPAER
515 DT = TP2 - TP1
    TP1 = TP2
    GO TO (525, 520), IPP
520 PBAR = .5 * (PR (J, LUD) + PR (J + 1, LUD))
    DTDLND = PBAR * DT / (PR (J, LUD) - PR (J + 1, LUD))
    PRINT 1508, PBAR, T (J, LUD), DTDLND
    PUNCH 1510, PBAR, DTDLND
1508 FORMAT (1H0,F8.4,F14.2,F23.5)
1510 FORMAT (F7.1,F9.4)
    GO TO 550
C*****

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PLANCK FUNCTION

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C*****
525 PWR1 = Q * UNU / T (JCLUD)
    WW = T * .1
    IW = WW
    FLTRI1 = FLIR (IW + 1) + (WW - IW) * (FLIR (IW + 2) - FLIR (IW +
11))
    AI = .
    IF (PWR1 .LT. 690.) AI = P * UNU3 / (PI * (EXP (PWR1) - 1.))
530 IF (J .LT. MM) GO TO 545
    PWR2 = Q * UNU / ITBLUD
    IF (PWR2 .GE. 690.) GO TO 535
    AIO = P * UNU3 / (PI * (EXP (PWR2) - 1.))
    GO TO 540
535 AIO = 0.
540 SUM3 = SUM3 + AIO * IP2 * FLTRI1 * FACT
545 SUM = SUM + AI * DT * FLTRI1 * FACT
550 CONTINUE
765 CONTINUE
C*****
C                                     END OF HEIGHT LOOP
C*****
GO TO (555, 565), IPP
555 SUM2 = SUM2 + SUM
GO TO (560, 565), ISPRAD
560 AII = SUMS - SUM
    AII = AII / FACT
    PRINT 1512, UNU, AII
1512 FORMAT (2F20.8)
565 CONTINUE
760 CONTINUE
C*****
C                                     END OF FREQUENCY LOOP
C*****
GO TO (570, 540), IPP
570 AII = (SUM3 - SUM2) * UNU
    IF ((INFLAG (20) .EQ. 0) .AND. (INFLAG (21) .EQ. 0)) GO TO 585
    FWZ = AII - RNOBS
    IF (INFLAG (21) .EQ. 1) GO TO 580
    WP = W0 * 1000.
    GO TO (575, 580), MODE
575 PRINT 1514, WP, AII, DUX, FWZ
1514 FORMAT (1H0,F15.2,E24.6,E21.6,E18.4)
580 RETURN
585 IF (INFLAG (18) .EQ. 0) GO TO 590
    ML = ML + 1
    FNET (ML, LUD) = AII * PI * .E+4 / 699.
590 AIII (K) = AII * WSC (K)
    GO TO (595, 635), IBRIE
595 ASSIGN 640 TO NWRITE
600 DO 605 LOOK = 1, 75
    IF (AII - BBODY (LOOK)) 615, 610, 605
605 CONTINUE
    TEQBB = 100.
    GO TO 630
610 TEQBB = 5. * (LOOK - 1) - 27.
    GO TO 630

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615 IF (LOOK - 1) 625, 620, 625
620 TEQBB = - 270.
GO TO 630
625 TEQBB = 5. * (LOOK - 2) - 27. + 5. * (AII - BBODY (LOOK - 1)) / (
BBODY (LOOK) - BBODY (LOOK - 1))
630 TATM = TO (M, LUD) - TEQBB
PRINT 1516, IHEIA (K), AII, XCX, XUX, TEQBB, TATM
1516 FORMAT (5X, F9.2, E15.4, F12.4, E13.3, 2F8.1)
GO TO NBRITE, (640, 275)
635 PRINT 1518, IHEIA (K), AII, XCX, XUX
NLINEC = NLINEC + 1
1518 FORMAT (5X, F9.2, E15.4, F12.4, E13.3)
640 K=K+1
IF (K, E, ANGLES) GO TO 281
C*****
C END OF ANGULAR LOOP
C*****
GO TO (645, 725), IPP
645 MKO = MKN
SUM7 = AIII (1) + AIII (2) + AIII (3)
MKOLUD = MKO + LUDU
PRINT 1520, PR (MKOLUD), TO MKOLUD, W (MKOLUD), DDELU (MKOLUD),
1SUM7.
1520 FORMAT (F8.1, F11.1, F13.4, E12.3, E15.6/)
NLINEC = NLINEC + 1
IF (NLINEC .LT. 30) GO TO 65
NLINEC = 0
NPAGE = NPAGE + 1
CALL HEADING (LUD)
650 MK=MK, LEVELS
IF (MK, LE, MKL) GO TO 281
750 CONTINUE
NPAGE = 1
NLINEC = 0
655 CONTINUE
745 CONTINUE
IF (INFLAG (18) .EQ. 0) GO TO 725
MKK = MKF + 1
IF (MKF .LT. 1) GO TO 770
DO 660 MK = 1, MKF
MKP = MKK - MK
660 VNET (MK) = FNET (MK, 1) - FNET (MKP, 2)
770 CONTINUE
PRINT 1522
1522 FORMAT (*1PRESSURE F (NET) ATM. TEMP. CHANGE*/ )
CONATM = 5880.
PRINT 1524, PR (1, 2), VNET (1), ZERO
1524 FORMAT (F8.1, F14.4, F10.1)
PUNCH 1526, PR (1, 2), IO (1, 2), FNET (1, 1), FNET (MKF, 2), VNET
1 (1), ZERO
IF (MKF .LT. 2) GO TO 775
DO 660 MK = 2, MKF
ATMCH = (VNET (MK - 1) - VNET (MK)) / (PR (MK - 1, 2) - PR (MK, 2))
1) * CONATM
PRINT 1524, PR (MK, 2), VNET (MK), ATMCH
MKP = MKK - MK
PUNCH 1526, PR (MK, 2), TO (MK, 2), FNET (MK, 1), FNET (MKP, 2), V

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      INET (MK), ATMCH
1520 FORMAT (1X,F7.1,8X,F8.1,3F8.4,F8.1)
665  CONTINUE
775  CONTINUE
      GO TO 725
C*****
C                                     BLACK BODY CALIBRATION LOOP
C*****
670  ASSIGN 080 TO IST
      NLINEC = 0
      NPAGE = 1
      TEMP = 11
      ASSIGN 710 TO IBLACK
675  GO TO IST, (080, 085)
680  ASSIGN 085 TO IST
      CALL HEADING (3)
      PRINT 1528
1528 FORMAT (* TEMP*,6X,*IRRADIANCE*,8X,*RADIANCE*,6X,*RADIANCE*/
1 15X,*W/SQ CM*,8X,*W/SQ CM SR*,5X,* (NORMAL)* /)
685  SUM6 = SUM5 = 0.
      IF (NU2 .LT. NU1) GO TO 780
      DO 700 I = NU1, NU2, NU3
      UNU = I
      PWR3 = Q * UNU / (TEMP + 273.16)
      AI = 2.
      IF (PWR3 .LT. 690.) AI = P * UNU * 3 / (PI * (EXP (PWR3) - 1.))
      WW = 1 * .1
      IW = WW
      FLTR(I) = FLIR (IW + 1) + (WW - IW) * (FLTR (IW + 2) - FLIR (IW +
11))
      SUM66 = AI * FLIRIII * UNU
      SUM55 = FLTRIII
690  IF ((I .EQ. NU1) .OR. (I .EQ. NU2)) 695, 700
695  SUM66 = SUM66 * .5
      SUM55 = SUM55 * .5
700  SUM6 = SUM6 + SUM66
      SUM5 = SUM5 + SUM55
705  CONTINUE
780  CONTINUE
      GO TO IBLACK, (710, 235, 255)
710  SUMN = SUM6 / SUM5
      SUM7 = SUM6 * CC22
      PRINT 1530, TEMP, SUM7, SUM6, SUMN
1530 FORMAT (F7.1,E18.6,2F14.7)
      NLINEC = NLINEC + 1
      IF (NLINEC .GE. 50) 715, 720
715  NLINEC = 0
      NPAGE = NPAGE + 1
      ASSIGN 080 TO IST
720  TEMP = TEMP + 10
      IF (TEMP .LE. 715) 675, 725
725  RETURN
      END

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SUBROUTINE TAPRNT (AL, IHDA1)
COMMON /TRANS /IWAI, IWAD, NTWA, TT (50), TCO1, TCO2, NTCO, ITC (7
14), TO1, TO2, NT02, TT02(41)
DIMENSION AL (249), IHDA1 (2)
DIMENSION IFRQ (5), VAL (5)
ENTRY VLNPRNT
PRINT 1500, IHDA1
1500 FORMAT (1H1,36X,2A8//2X,5( * FREQ LN(L)*)/)
DO 100 II = 1, 29
KK = II
DO 100 JJ = 1, 5
IFRQ (JJ) = (KK - 1) * 10
VAL (JJ) = AL (KK)
100 KK = KK + 50
PRINT 1502, (IFRQ (I), VAL (I), I = 1, 5)
1502 FORMAT (2X,5(17,F7.2))
105 CONTINUE
DO 110 II = 30, 50
KK = II
DO 110 JJ = 1, 4
IFRQ (JJ) = (KK - 1) * 10
VAL (JJ) = AL (KK)
110 KK = KK + 50
PRINT 1502, (IFRQ (I), VAL (I), I = 1, 4)
115 CONTINUE
RETURN
ENTRY TWATER
PRINT 1504
1504 FORMAT (1H1,31X,*WATER VAPOR*//7X,*LN(L) TAU*,2(8X,*LN(L)
1TAU*)/)
DO 120 I = 18, 20
I3 = I + 20
VLNA = I * .1 - 3.8
VLNB = VLNA + 2.
PRINT 1506, VLNA, TT (I), VLNB, TT (I3)
1506 FORMAT (21X,2(F11.1,F10.4))
120 CONTINUE
DO 120 I = 1, 10
I2 = I + 20
I3 = I2 + 20
VLNA = I * .1 - 3.8
VLNB = VLNA + 2.
VLNC = VLNB + 2.
PRINT 1508, VLNA, TT (I), VLNB, TT (I2), VLNC, TT (I3)
1508 FORMAT (3(F11.1,F10.4))
125 CONTINUE
DO 130 I = 11, 17
I2 = I + 20
VLNA = I * .1 - 3.8
VLNB = VLNA + 2.
PRINT 1508, VLNA, TT (I), VLNB, TT (I2)
130 CONTINUE
RETURN
ENTRY TCARBON
PRINT 1510
1510 FORMAT (1H1,29X,*CARBON DIOX*DE*//
1 7X,*LN(L)*,5X,*TAU*,2(8X,*N(L) TAU*)/)

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DO 130 I = 1, 2
VLNA = I * .1 - 5.3
PRINT 1508, VLNA, TTC (I)
135 CONTINUE
DO 140 I = 3, 14
I2 = I + 30
I3 = I2 + 30
VLNA = I * .1 - 5.3
VLNB = VLNA + 3.
VLNC = VLNB + 3.
PRINT 1508, VLNA, TTC (I), VLNB, TTC (I2), VLNC, TTC (I3)
140 CONTINUE
DO 145 I = 15, 32
I2 = I + 30
VLNA = I * .1 - 5.3
VLNB = VLNA + 3.
PRINT 1508, VLNA, TTC (I), VLNB, TTC (I2)
145 CONTINUE
RETURN
END

```

```

SUBROUTINE HEADWAT (LUD)
C*****
C      PRINT HEADING AND INPUT PARAMETERS
C*****
C      COMMON /HEAD /ISTA, MDATE, NDATE, WL1, IWL2, IF1, IF2, FNU1, FNU2,
1 NPAGE, DNU, NPTW, IURIE
C
C      DIMENSION NHEAD (3)
C
C      DATA (NHEAD = 8H UPWARD, 8H DOWNWARD, 8HBB CALIB)
PRINT 1500, ISTA, MDATE, NDATE, NPAGE
1500  FORMAT (1H1,*STATION,*,A8,5X,*DATE,*,A8,66X,*CALCULATED,*,A8,
1 5X,*PAGE *,I3)
PRINT 1502, WL1, IWL2, IF1, IF2
1502  FORMAT (*WAVE LENGTH REGION FROM *,F8.2,* TO *,A8,
1 * MICRONS WITH FILTER = *,2 B)
LL = 100
PRINT 1504, FNU1, FNU2, DNU, NHEAD (LL), NPTW
1504  FORMAT (7X,*WAVE NUMBERS FROM *,F8.2,* TO *,F8.2,* BY *,F8.2,28X,
1 A8,* RADIANT POWER FOR *,I3,* LAYERS*)
PRINT 1506
1506  FORMAT (1H0,11X,*W 0*,15X,*RADIANCE*,11X,*WATER VAPOR*,9X,
1 *DIFFERENCE*/12X,3HPPM,14X,*W/SQ CM SR*,30X,*W/SQ CM SR*/)
RETURN
END

```

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SUBROUTINE HEADING (LUU)

C*****
C PRINT HEADING AND INPUT PARAMETERS
C*****

C COMMON /HEAD /ISTA, MDATE, NDATE, WL1, IWL2, IF1, IF2, FNU1, FNU2,
1 NPAGE, DNU, NPIW, IRRITE

C DIMENSION NHEAD (3)

C DATA (NHEAD = 8H UPWARD, 8H DOWNWARD, 8HBB CALIB)

PRINT 1500, ISTA, MDATE, NDATE, NPAGE

1500 FORMAT (1H1, STATION, A8, S, DATE, A8, 66X, CALCULATED, A8,
1 5X, PAGE, I3)

PRINT 1502, WL1, IWL2, IF1, IF2

1502 FORMAT (WAVELENGTH REGION FROM F8.2, TO A8,
1 MICRONS WITH FILTER = I2.8)

LL = IUD

PRINT 1504, FNU1, FNU2, DNU, NHEAD (LL), NPIW

1504 FORMAT (7X, WAVE NUMBERS FROM F8.2, TO F8.2, BY F8.2, 28X,

1 A8, RADIANT POWER FOR I3, LAYERS)

GO TO (100, 105), IRRITE

100 PRINT 1506

1506 FORMAT (PRESSURE, 5X, TEMP, 5X, MIX RATIO, 5X, DELU, 5X, IRRADI
1 ANCE, 5X, ANGLE, 5X, RADIANCE, 8X, CO 2, 8X, H2O, 7X, BRIGHT ATM
2 / 49X, W/SQ CM, 15X, W/SQ CM SR, 1X, 2 (4X, GM/SQ CM), 5X, TEMP, 4X,
3 CORP)

RETURN

105 PRINT 1508

1508 FORMAT (PRESSURE, 5X, TEMP, 5X, MIX RATIO, 5X, DELU, 5X, IRRADI
1 ANCE, 5X, ANGLE, 5X, RADIANCE, 8X, CO 2, 8X, H2O
2 / 49X, W/SQ CM, 15X, W/SQ CM SR, 1X, 2 (4X, GM/SQ CM))

RETURN

END

FUNCTION TAUW (VNU)

C WATER TRANSMITTANCE FOR NU = (2 2.5+797.5) BY 5.

COMMON /XYZW /X, Y, Z, C (9, 120)

W (I) = C (1, I) + Z * (C (4, I) + C (9, I) * Y * Z) + X * (C (2,
11) + 7 * (C (6, I) + C (8, I) * X) + C (7, I) * X) + Y * (C (3, I)
2 + C (5, I) * X)

WS = (VNU - 202.5) * .2

IL = WS

WL = W (IL + 1)

WA = WL + (WS - IL) * (W (IL + 2) - WL)

TAUW = EXP (- EXP (WA))

RETURN

END

```

FUNCTION TAUCD (VNU)
C CARBON DIOXIDE TRANSMITTANCE FOR NU = (507.5+817.5) BY 5.
COMMON /XYZ /X, Y, Z, CCD (9, 63)
W (1) = CCD (1, 1) + Z * (CCD (4, 1) + X * (CCD (6, 1) + CCD (9, 1)
1) * Z)) + CCD (3, 1) * Y + X * (CCD (2, 1) + CCD (5, 1) * Y + X *
2(CCD (7, 1) + CCD (8, 1) * Y))
WS = (VNU - 507.5) * .2
IL = WS
WL = W (IL + 1)
WA = WL + (WS - IL) * (W (IL + 2) - WL)
TAUCD = EXP ( - EXP (WA))
RETURN
END

```

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SUBROUTINE DUMMY1

COMMON /XYZW /WX, WY, WZ, CW (9, 120)

DATA (CW = 6.1218, .9142, .9 11, -.4376, .04956, 0., .01814, 2 (0
1.), 6.175, 1.0287, .9704, 0., .05400, .0989, .0244, 2 (0.), 5.6094
2., .9578, .916, 0., .05039, -.0841, .02266, 2 (0.), 4.8955, .988,
3.9591, 0., .04072, 0., .01177, 2 (0.), 5.3723, .8413, .8257, - 1.2
4625, .03251, -.2771, .01391, -.01445, 0., 4.8715, .6848, .662, 0
5., .05101, .0097, .00952, -.00131, .1005, 3.8296, .6492, .6619, 0
6., .05255, -.2476, .00096, 0., .69852, 4.0639, .9648, .9847, 0.,
7.0180, 2 (0.), .02738, 0., .8635, .8249, .7741, 0., .03037, 0.,
8.0154, .01957, .5033, 5.4739, .797, .7156, 2.1261, .02349, .4997
9., .01409, .03768, 0., 5.5674, 1.0058, .0283, 0., .06286, -.0611,
A.0303, 2 (0.), 3.5271, .597, .6273, 0., -.01128, -.1407, -.01
8135, 2 (0.), 4.2338, 1.0235, 1.0361, .5353)

DATA (CW(I), I=113, 222)

X = .05418, -.352, .00800, 2 (0.), 3.0032, .6309, .
16164, .4302, .02130, -.1506, .00892, 2 (0.), 3.9064, .8782, .896,
2.3700, .02857, -.2016, 2 (0.), 1.17741, 4.0603, .4581, .5423, 0.
3., -.0043, -.2114, -.01271, -.01834, 0., 3.966, .6008, .5025, 1
4.3724, .01139, .0731, .00522, 2 (0.), 4.5389, .9895, .8969, .9405,
5.06606, 0., .03052, 2 (0.), 3.4817, .8052, .7685, 1.0741, .02127,
6 0., .01061, 2 (0.), 3.7495, .8629, .8675, 1.1067, .04929, -.1472
7., .0150, 2 (0.), 4.4459, .7224, .6912, 1.3678, .03165, 0., .01193
8., 2 (0.), 3.8072, .8714, .9022, 1.493, .0357, 4 (0.), 3.4957, .970
97, .804, 1.6149, .07145, 0., .02854, -.01295, 0., 3.5555, 1.059,
A.9694, 1.3177, .07048, .0567, .03522, 2 (0.), 3.4924, .7124, .6683
B, 1.0064, .03905, 0.)

DATA (CW(I), I=223, 334)

X = .01392, 2 (0.), 4.1125, .7887, .7497, 1.8633, .03
1729, .0722, .01516, 2 (0.), 1.6888, .9455, .8726, 1.4606, .05094,
20., .222, -.02487, 0., 3.5 36, .9852, .8872, 1.0675, .07393, 0.,
3.03308, -.01505, 0., 3.1583, .7363, .7083, 1.6959, .03384, .0346
4., .01785, 2 (0.), 3.2042, .807, .7648, 1.5694, .05751, 0., .0198,
5 2 (0.), 4.7227, .859, .7921, 2.5143, .04153, 0., .01961, -.01034
6, 0., 3.113, .5768, .5826, 1.6107, 0., .0556, -.00328, 0., 0., 2.
75079, .9242, .9058, 1.8898, .85049, 2 (0.), .02292, 0., 2.2004, .8
8052, .7417, 1.3649, .05537, 0., .01964, 2 (0.), 2.9026, .7342, .67
951, 1.7771, .03578, 0., .01517, 2 (0.), 2.3168, .5871, .5786, 1.71
A72, .2019, -.1343, .006, 2 (0.), 2.2172, .7155, .6467, 1.584, .0
B4174, 0., .01497, 2 (0.), 1.0742)

DATA (CW(I), I=335, 441)

X = .733, .6939, 1.126, .07095, .2008, .01552, .00321
1, -.4347, 2.1226, .7255, .6.79, 2.1168, .03257, -.1092, .01478,
22 (0.), 3.5291, .6982, .6678, 2.4057, .02918, .0462, .00977, 2 (0.
3), 1.0393, .786, .7273, 2.263, .05824, .145, .02125, .04745, 0., 1
4.4888, .9428, .9105, 2.0498, .06549, -.1445, .00218, 2 (0.), 1.59
507, .075, .9429, 1.4218, .0612, -.1439, .00204, 2 (0.), 2.1667,
6.4856, .4527, 1.1492, .01137, -.0894, .00441, 2 (0.), 2.5673, .69
786, .2758, 2.7325, .01806, .1562, .00325, .03342, 0., 1.6873, .729
83, .6067, 1.2854, .05759, 0., .00607, .04438, 0., 1.6176, .7252, .
96952, 1.361, .05026, 0., .0011, 2 (0.), 1.6237, .7975, .7471, 2.4
A456, .04392, -.3088, .01379, 2 (0.), 1.9632, .6293, .6136, 1.2863
B, .03789, 0., .00558, 2 (0.)

DATA (CW(I), I=442, 540)

X = 1.4718, .754, .701, 2.8388, .06191, -.299, .005
144, .0279, .5211, 1.7591, .7715, .7163, 2.7152, .05552, -.1637, .
200638, .01725, .30805, 2.2750, .679, .6232, 1.6932, .03735, .0797,
3.0134, 2 (0.), 1.3413, .8111, .7501, 2.3745, .05334, -.321, .00
4833, .0213, .68252, 1.4035, .7618, .6937, 2.461, .06784, -.3545,
5.00104, .03859, .26821, 1.2306, .65, .6559, 1.4577, .03822, .0231,
6.01124, 2 (0.), .9939, .8646, .8111, 1.8684, .05137, -.3699, .01
7051, .05305, 1.60593, 1.4496, .6708, .6215, 1.1994, .03321, .0669,
8.00601, 2 (0.), 1.0059, .83, .751, 1.9138, .06045, -.3055, .004
909, .5065, 1.47211, 1.1967, .683, .609, 2.2477, .05734, -.1047,
A.00257, .0209, 0., .4625, 1.0025, .927, 1.9155, .05779, -.0633, 3
B (0.)

END

SUBROUTINE DUMMY2

COMMO: /XYZW /WX, WY, WZ, CW (9, 120)

DATA(CW(I), I=541, 660)

X = 1.7019, .7317, .6852, 3.4872, .04482, 0., .01091,
 1 0., .03921, 1.35, .711, .6873, 2.0314, .04018, 0., .01015, 2 (0.)
 2, 1.0144, .7584, .6897, 3.6419, .07208, -.4356, -.01145, .03452,
 3 .435, 1.9939, .6404, .6237, 3.413, .03157, 3 (0.), -.09615, .965
 49, .8632, .817, 3.4202, .05245, 0., -.01085, 0., 0., .9526, .6237
 5, .5703, 2.4008, .02423, 0., .00692, 2 (0.), .1357, .8832, .7762,
 62.7012, .0439, -.5505, -.0961, 0., 1.7478, .6216, .7386, .6645,
 7 2.0522, .06475, 4 (0.), .5929, .8461, .7347, 1.7532, .06477, 4 (0
 8.), 1.4393, .6638, .6320, 2.433, .05921, 4 (0.), .6297, .7306, .6
 9532, 2.1938, .06557, 2 (0.), .04194, 0., .0977, .8421, .729, 2.314
 A5, .0239, -.3976, -.01518, 0., 1.32521, .325, .7953, .6907, 1.3
 B819, .07604, 4 (0.), 1.0674, .6348, .6022)

DATA(CW(I), I=661, 772)

X = 1.3958, .04387, 2 (0.), .02679, 0., .4668, .865,
 1.7523, 3.2109, .05747, -.978, 2 (0.), 2.045, .7381, .7151, .6861
 2, 2.958, .04528, 0., .01002, 2 (0.), .8434, .642, .5703, 2.7075,
 3.0580, 2 (0.), .06374, 0., .003, .9233, .8748, 3.4166, 0., -.183
 49, -.00702, 2 (0.), 1.1164, .6576, .6401, 2.4402, .06297, .1755,
 5.00247, .05418, -.45706, .2369, .7363, .7574, 2.8881, 0., -.237,
 6 -.01633, 2 (0.), .1762, .631, .6424, 2.8055, .06562, -.172, 0.
 7, .05076, 0., -.6216, .9947, .8931, 2.0704, .03317, -.144, 3 (0.
 8), -.0405, .8616, .7101, 1.4924, .08775, 4 (0.), .3722, .6929, .6
 9368, .8036, .06067, 2 (0.), .02005, 0., .1257, .7646, .7079, 2.93
 A73, .75921, -.7088, -.0106, .02441, 2.01896, .0336, .6296, .586
 B7, 2.2144, .05046, 2 (0.)

DATA(CW(I), I=773, 880)

X = .05117, .2812, .0114, .7898, .7005, 3.084, .0826
 19, -.3355, 2 (0.), .20618, -.6751, .6990, .6284, 2.558, .06208, 2
 2(0.), .06243, -.09255, .165, .7703, .4617, 3.1227, .08209, 2 (0.
 3), .0605, 0., -.6688, .872, .7498, 1.3178, .06925, 0., -.0153,
 4 0., .0415, .8013, .7676, 1.5691, .10389, -.5763, 0., 0., 1
 5.2119, -.1863, .5866, .587, .9089, .7812, -.2625, -.01946, .
 602767, .32135, -.3255, .8984, .7576, 1.3227, .07789, 0., 0., .037
 708, 0., -.177, .7475, .6674, .9509, .07456, 4 (0.), -.2946, .793
 83, .6489, 2.0613, .093, -.435, -.01658, 0., .2332, -.6008, .80
 969, .7206, 1.2687, .04204, -.2858, -.0106, 0., 0., -1.2156, 1.0
 A442, .9708, .2732, .02229, -.0567, .01363, 0., 0., .0344, .7086,
 B.0034, 1.8627, .05647, 0., 0.)

DATA(CW(I), I=881, 987)

X = .08283, .94146, -.1431, .6964, .6444, 2.1392, .0
 1816, -.4796, -.01772, 0., .65367, .0812, .6968, .6318, 2.3108, .
 208782, -.2794, -.01659, .0327, 0., -.585, .8702, .7589, 2.3439
 3, .08026, -.5944, 0., 0., 1.88005, -.001, .6293, .5967, 1.3822,
 4.0742, -.2653, -.01974, .1468, 0., -.5983, .729, .602, 1.8982
 5, .07491, -.6150, -.02065, 0., 1.913, -1.2443, .986, .8534, .67
 612, .33676, -.1938, 3 (0.), -1.2809, .98, .8618, 1.0699, .06606,
 7 -.35, 3 (0.), -.9128, .7659, .6462, .7983, .06223, -.5689, .
 801932, -.03856, 1.52970, -.8131, .7871, .6877, 1.1119, .09877, .
 9 .4304, -.0149, -.053, 0., -1.4145, 1.0079, 1.0109, 6 (0.), .
 A2006, .7076, .6073, 3.2032, .08244, -.5402, -.01924, 0., 0., .
 B8597, .8564, .7451, 1.1123, .104, -.2117)

DATA(CW(I), I=988, 1080)

X = -.00685, 0., 0., -.6852, .7274, .6021, 2.042, .
 107252, -.8034, -.02399, -.76718, 1.36298, -1.246, .9611, .8279
 2, 1.7005, .0522, -.0282, -.0012, -.07092, .98989, -1.5561, 1.0
 3101, .8169, 0., .06095, -.0026, 0., 0., 1.40942, -1.217, .9208,
 4.7144, .6104, .09037, -.1294, -.00574, 0., 0., -1.3441, .922, .
 57982, 1.1841, .07038, -.6780, -.00429, -.0595, 1.03903, -.68,
 6.7769, .5818, 2.2546, .07059, -.4801, -.02203, 0., 2.42264, -1.
 70037, .7783, .6493, .9905, .9013, -.5305, -.01597, -.02272, 1.
 821459, -1.5633, 1.0068, .9846, 6 (0.), -1.2125, .878, .7274, 1.7
 9113, .06813, -.7937, -.00675, -.05651, 1.88107, -.2592, .6565,
 A .566A, 2.2743, .06738, -.3331, -.02609, 0., 0.)

END

SUBROUTINE DUMMY3

COMMON /XYZ /DX, DY, DZ, CCD (9, 63)

DATA (CCD) = -12.5563, 1.2510, 0., 0., - .17329, 0., 0., .039227,
 1.0465, - 9.0048, 3 (0.), - .13531, .4108, .12205, .03486, 0., - 9.
 21021, 0., 0., 3.0247, - .135.6, 0., .13428, .036523, 0., - 7.5255,
 3 - .5454, - .2070, 3.1339, 0., 0., .18201, .018728, 0., - 7.8368,
 44 (0.), .7787, .11912, .012167, 0., - 11.4741, 1.3374, - .1906, 3.
 55957, 3 (0.), .019534, 0., - 7.9647, 0., 0., 3.5359, 0., 0., .1240
 69, .013978, 0., - 8.719, .7699, 0., .4472, - .0469, 2.79, .04769,
 7.019071, .33903, - 9.1824, 1.1398, 0., 1.7502, 0., 2.3209, 0., .01
 80606, - .2891, - 10.2269, 1.2544, 0., 4.856, 3 (0.), .014981, 0.,
 9- 8.1479, .5104, 3 (0.), 2.1 21, .07902, .014411, - .20992, - 8.21
 A75, .7508, 0., 8.0119, 0., - .3037, .05557, .01392, 0., - 8.0988,
 B1.1254, - .0707, 7.8959, .04 21, 0.)

DATA (CCD(I), I=115, 205)

X = 0., .006407, - .05619, - 6.9298, .8914, 0., 6.68
 112, 0., .4478, .02279, .012015, - .1162, - 6.2296, .9875, 0., 6.98
 221, .03299, 0., 0., .006158, - .06665, - 5.65, 1.0686, .0281, 6.23
 319, .03985, 0., - .01791, .005244, - .06194, - 4.8285, .9965, .096
 49, 5.1455, .06422, - .0355, .0215, 0., - .05157, - 4.011, .9665,
 5 .1514, 4.2198, .06243, - .079, - .02806, - .001882, - .03566, -
 63.4127, .952, .1649, 4.3297, .05547, - .3231, - .02286, - .001121,
 7 .02223, - 3.2484, .898, .24 3, 3.0533, .07241, - .2081, - .02458,
 8 - .004735, .02090, - 3.2611, .8686, .2645, 2.5396, .004, - .1455,
 9 - .01883, - .0036, .01449, - 3.3509, .9495, .215, 2.7713, .0747,
 A- .1874, - .02394, - .003601, .01682, - 1.5126, .8122, .2711, 2.72
 B53, .0616, - .3039, - .04478)

DATA (CCD(I), I=206, 295)

X = - .007887, .0155, - 1.953, .8463, .2533, 2.8342,
 1 .06601, - .287, - .03243, - .005338, .01959, - 2.1364, .9037, .26
 248, 2.5098, .08027, - .2002, - .03121, - .006357, .01305, - 1.5385
 3, .8421, .3189, 2.1101, .07001, - .1432, - .02476, - .005504, .010
 459, - 1.0136, .1503, .3827, .4426, .04069, - .0675, - .01575, - .
 5003480, .0054, - .5580, .6964, .4134, 1.0127, .03247, 0., - .01025
 6, - .001676, - .00434, - .016, .7252, .4053, .6414, .03872, .0339
 7, - .01753, - .00305, - .00761, .0036, .6937, .4501, .0877, .0359,
 8 .018, - .00761, - .001986, - .00745, - .114, .6918, .4622, - .206
 90, .07604, 0., 0., - .00095, 0., .2529, .6475, .4216, - .3619, .02
 A348, .0506, - .00542, 0., - .00645, 1.3638, .5246, .434, .0297, .0
 B0662, - .0893, - .00503, - .000057)

END

SUBROUTINE DUMMY4

COMMON /XYZ /DX, DY, DZ, CCD (9, 63)

DATA (CCD(I), I=297, 387)

```

X      = .00695, .37, .5234, .797, .1252, .02322, -.0779-
1, .01701, .001827, 0., .0623, .6726, .4355, -.1532, .03386, .0044
2, .0078, -.001429, -.0023, .016, .6533, .4873, .0948, .02865,
3, .0179, .00028, -.001026, -.00338, -.2339, .6633, .4764, .5516,
4, .02984, .0232, .00071, -.000737, -.0052, -.5269, .6672, .4586,
5, .0247, .03113, 0., -.00153, -.001029, 0., -.9326, .6943, .4371
6, .15464, .03741, -.0096, -.00634, -.002023, -.00233, -.14106-
7, .757, .3814, .22672, .0494, -.0849, -.01173, -.003104, .0030
81, -.19623, .8219, .327, .24036, .06731, -.2118, -.01992, -.00
94881, .01569, -.2546, .879, .2863, .2918, .07776, -.2568, -.021
A24, -.005440, .02821, -.165, .8043, .2803, .29613, .06098, -.12
B036, -.03415, -.005813, .01779)

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DATA (CCD(I), I=388, 479)

```

X      = -1.427, .581, .3052, 2.4273, .05335, -.3081,
1 = .0472, -.008055, .0217, -.33026, .8857, .2736, 2.4157, .07142
2, -.1082, -.01824, -.00335, .01325, -.29767, .8424, .2988, 2.
34131, .06911, -.1974, -.01577, -.004364, .02716, -.30163, .874
41, .2597, .31387, .06681, -.121, -.02305, -.004251, .01214, -.3
5.1692, .9078, .2253, .39284, .06231, -.171, -.02981, -.003541,
60., -.4099, .9514, .1827, .43132, .0887, -.2173, -.02716, -.0
704737, 0., -.40736, .9831, .118, .53603, .06576, -.019, -.02236
8, 0., -.04328, -.57219, .998, .0484, 7.249, .03511, 0., -.00874
9, .00046, -.0089, -.06114, .9978, 0., .80478, .0433, 0., 0., .0
A05637, -.07565, -.74221, 1.0581, 0., .1331, .04566, 0., 0., .00
B4869, -.08853, -.78763, .8391)

```

DATA (CCD(I), I=480, 507)

```

X      = -.0351, 6.5719, .01215, .6383, .04162, .012539,
1 = .17963, -.83537, .8692, -.0411, 7.7879, 0., 0., .03817, .0149
224, -.05194, -.90114, .983, -.0811, .20357, .01224, 1.81, .0277
35, .014138, -.22558, -.7446, .9695, 0., 4.9493, .02164, 1.0906,
40., .005778, -.18784, -.71057, .9791, 0., 6.0877, 0., .6197, 0.
5, .000747, -.14249, -.71605, .5334, .2257, 10.4273, 0., .68167,
6.01927, 0., .14102, -.8845, 1.0065, -.4464, 8.2588, .16741, -
7.8311, .00973, -.000534, 0., -.77652, .5169, 3 (0.), 2.51, .0595
86, .011644, -.28153, -.83159, .6049, 0., -.8062, -.03048, 3.09
995, .25332, .016666, -.3415, -.94568, 1.0304, 0., 6.3498, 3 (0.)
A, .01164, 0.)

```

END

SUBROUTINE DUMMY5

COMMON /ALFLIR /AL (229), FLTR (229)

```

DATA /AL = 1.10, 1.40, 1.62, 1.90, 2.04, 2.20, 2.30, 2.40, 2.47, 2
1.55, 2.60, 2.65, 2.67, 2.68, 2.68, 2.69, 2.69, 2.67, 2.65, 2.63, 2
2.61, 2.57, 2.53, 2.48, 2.45, 2.40, 2.35, 2.30, 2.23, 2.15, 2.10, 2
3.03, 1.96, 1.87, 1.80, 1.72, 1.65, 1.57, 1.50, 1.42, 1.30, 1.20, 1
4.12, 1.03, .95, .87, .77, .67, .60, .52, .42, .33, .23, .15, .05,
5, .03, -.15, -.21, -.30, -.42, -.55, -.65, -.74, -.85, -.
697, -.107, -.120, -.131, -.142, -.155, -.166, -.179, 37 (-
7 8.00)

```

DATA (AL(I), I=110, 216)

```

X      = 17 (-8.00), -.65, -.50, -.26, -.13, .05, .2
10, .33, .50, .63, .73, .85, .97, 1.07, 1.17, 1.27, 1.37, 1.45, 1.5
25, 1.64, 1.75, 1.84, 1.95, 2.05, 2.15, 2.28, 2.40, 2.46, 2.42, 2.2
38, 2.16, 2.01, 1.75, 1.57, 1.48, 1.56, 1.67, 1.83, 1.98, 2.08, 2.1
46, 2.22, 2.28, 2.29, 2.28, 2.26, 2.23, 2.17, 2.12, 2.06, 1.97, 1.8
50, 1.76, 1.68, 1.50, 1.38, 1.27, 1.14, 1.03, .91, .82, .71, .61, .
650, .41, .31, .22, .14, .07, -.02, -.12, -.21, -.28, -.40, -
7.49, -.59, -.66, -.76, -.86, -.96, -1.07, -1.17, -1.28, -
81.40, -1.50, -1.63, -1.76, -1.88, -2.00, -2.14, -2.29)

```

DATA (AL(I), I=217, 229)

```

X      = -2.42, -2.55, -2.72, -2.87, -3.03, -3.20, -
1 3.38, -3.55, -3.69, -3.85, -4.03, -4.22, -4.41)

```

DATA (FLTR = 229 (1.0))

END

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SUBROUTINE DUMMY6

COMMON /ALCALW/ ALC(229),ALW(229),ALOZ(229),OZMXR(19),OZPRS(19)

C*****

C OZ(L) TABLES FOR CO₂ WINDOW, AND OZONE (FROM ELSASSER)

C*****

DATA (ALC = 56 (0.)) = 4.97, - 4.05, - 3.30, - 2.63, - 2.06, - 1.5
 10, - 1.05, - .61, - .21, .16, .38, .43, .32, 0., - .34, - .72, - 1
 2.08, - 1.50, - 1.88, - 2.27, - 2.67, - 3.08, - 3.52, - 3.93, - 4.3
 39, - 4.53, 147 (0.))

DATA (ALW = 68 (0.)) = .81, - .71, - .73, - .75, - .76, - .77, - .
 178, - .80, - .81, - .83, - .84, - .86, - .87, - .89, - .91, - .92,
 2 - .94, - .95, - .97, - .99, - 1.01, - 1.02, - 1.04, - 1.06, - 1.0
 37, - 1.08, - 1.10, - 1.11, - 1.12, - 1.14, - 1.15, - 1.16, - 1.17,
 4 - 1.17, - 1.18, - 1.18, - 1.20, - 1.20, 4 (- 1.21), - 1.22, 5 (-
 5 - 1.21), - 1.20, - 1.19, - 1.18, - 1.16, - 1.14, 108 (0.))

DATA (ALOZ = 97 (0.)) = 2.2, - 1.4, - .8, - .4, - .5, .2, .3, .5, - .1, .5, .35,
 * -.7, -.7, .25, - 1.3, - 1.2, - 1.1, - 1.3, - 2.5, 114 (0.))

C*****

C MIXING RATIO VS. PRESSURE TABLES FOR OZONE

C*****

DATA (OZPRS = 1050., 1013., 615., 206., 356., 194., 145., 103., 55., 29.,
 * 23.7, 10., 0.13, .8, 8.4, 8.2, 8., 6., 2., 1)

DATA (OZMXR = 0.0, 3.9, 7.4, 8.4, 9.0, 15., 18., 43., 300., 733., 1037.,
 * 1154., 1180., 1103., 897., 702., 500., 370., 89.)

END

SUBROUTINE DUMMY7

COMMON /TRANS /TWA1, TWAD, NTWA, TT (50), TCO1, TCO2, NTCO, TIC (7
 14), TOZ1, TOZ2, NT0Z, T0Z (41)

C*****

C TAU TABLES FOR H₂O VAPOR, CO₂, AND OZONE (FROM ELSASSER)

C*****

DATA (TWA1 = - 3.7), (TWAD = .1), (NTWA = 50)

DATA (TI = 1., .999, .9967, .9932, .9887, .9833, .9772, .9705, .96
 133, .9556, .9475, .9389, .9298, .9200, .9094, .8978, .8851, .8711,
 2 - .8554, .8384, .8194, .7984, .7753, .7500, .7225, .6928, .6610, .6
 3272, .5915, .5541, .5152, .4750, .4338, .3919, .3497, .3076, .2661
 4, .2248, .1874, .1518, .1198, .0920, .0687, .0500, .0357, .0250, .
 50168, .0103, .0049, .0)

DATA (TCO1 = - 5.2), (TCO2 = .1), (NTCO = 74)

DATA (TIC = 1., .9997, .9991, .9982, .9970, .9955, .9937, .9916, .
 19892, .9865, .9835, .9802, .9766, .9727, .9685, .9639, .959, .9538
 2, .9402, .9422, .9358, .929, .9218, .9143, .9059, .8972, .8879, .8
 378, .8674, .8561, .844, .831, .817, .8019, .7856, .768, .7491, .72
 408, .7071, .6839, .6592, .633, .6053, .5762, .5458, .5142, .4815,
 5, .4478, .4133, .3782, .3428, .3075, .2727, .2389, .2066, .1763, .14
 684, .123, .1002, .0801, .0627, .048, .036, .0266, .0196, .0147, .0
 7113, .0089, .0071, .0056, .042, .0028, .0014, .0)

DATA (TOZ1 = - 4.3), (TOZ2 = .1), (T0Z = 41)

DATA (T10Z = 1., .992, .984, .974, .968, .96, .952, .944, .936, .927, .917,
 * .906, .894, .881, .866, .849, .83, .809, .786, .761, .734, .705, .673,
 * .683, .6, .559, .515, .468, .418, .366, .312, .257, .202, .151, .108,
 * .074, .048, .029, .015, .005, 0.0)

END

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SUBROUTINE PROFILE(M,NPTW,ALO,NU3)
COMMON /PARAMS /ID (6), XMIN, XMAX, YMIN, YMAX, NCYC
COMMON /PTW/XP(200),XT(200),X (200),TA(200)
COMMON /MEANS/PBAR(15),TBAR(15),IHEAD(8)
COMMON /PROF /RAUC (15), RADN (15), NFRQL (15), NFRQU (15), NFRQ
DIMENSION XX (15), DX (15), EE (15), XPE (15), TAE (15), XWE (15)
DIMENSION KX (10), PBAR (15), TBAR (15)
DIMENSION XTM (16, 15)
A=357.9110836
360 KX (1) = 1
    KX (2) = 1
    KX (3) = 1
    KX (4) = 0
    KX (5) = 10
    KX (6) = 500
    READ T534, IO
1534 FORMAT(8A10)
    READ T534, IHEAD
    PRINT 1536, IHEAD
1536 FORMAT (1H1,30X,8A10/)
    READ T538, XMIN, XMAX, YMIN, YMAX
1538 FORMAT (10F8.2)
    READ T540, NCYC
1540 FORMAT (11)
    CALL TINIT (A, B, C, U)
    ME = 1
    READ T540, MEX
    IF (MEX.EQ. 0) GO TO 385
    ME = T
    PRINT 1542
1542 FORMAT (/# PRES. TEMP. W EXACT#/) **
365 READ T544, XPE (ME), TAE (ME), XWE (ME)
1544 FORMAT (3F8.2)
    IF (XPE (ME))375, 375, 370
370 TAE (ME) = TAE (ME) + 273.16
    PRINT 1548, XPE (ME), TAE (ME), XWE (ME)
    ME = ME + 1
    GO TO 365
375 ME = ME - 1
    ME1 = ME - 1
    IF (ME1.LT. 1) GO TO 475 **
    DO 380 I = 1, ME1
        PBAR (I) = .5 * (XPE (I) + XPE (I + 1))
        TBAR (I) = .5 * (TAE (I) + TAE (I + 1))
380
475 CONTINUE **
    CALL TPLT (XPE, TAE, ME, 1)
385 PRINT 1546
1546 FORMAT (/# PRES. TEMP. W INITIAL GUESS#/) **
    IF (NPTW.LT. 1) GO TO 480
    DO 390 I = 1, NPTW
        PRINT 1548, XP (I), TA (I), XW (I)
1548 FORMAT (/F9.1,F12.2,F11.4)
390 CONTINUE
480 CONTINUE **
    PRINT 1550, ALO
1550 FORMAT (/# THEIA = %.F5.1)
C (PROCESS)

```



```

PRINT 1552
1552 FORMAT (//2H 1,3X*FREQUENCIES*,2X*RADIANCE*//)
      READ 1554, NFRQ, NU3
1554 FORMAT (I2,I4)
      IF (NFRQ .LT. 1) GO TO 485 **
      DO 400 I = 1, NFRQ
      READ 1556, NFRQL (I), NFRQU (I), RADO (I)
1556 FORMAT (2I5,F15.9)
395 PRINT 1558, I, NFRQL (I), NFRQU (I), RADO (I)
1558 FORMAT (/I2,2I5,F14.9)
400 CONTINUE **
485 CONTINUE **
      N = M - 1
      IF (N .LT. 2) GO TO 490 **
      DO 400 I = 1, N
      XX (I - 1) = TA (I)
405 UX (I - 1) = 10. **
490 CONTINUE **
      V = 0.
      KX (7) = KX (8) = KX (9) = KV (10) = 0
      NITER = 0
      Z = 1.
      CALL CALC (XX, EE, V)
      ASSIGN 410 TO KPRT
      GO TO 415
410 ASSIGN 450 TO KPRT
      DO 450 NITER = 1, 20
      CALL INMYZ (XX, UX, N = 1, EE, NFRQ, Z, KX, V, XTM)
415 PRINT 1560, V, (KX (J), J = 7, 10), NITER
1560 FORMAT (//* P*,4X,* T U = *,E9.3,4I4,10X,*NITER = *,I2)
1
      IF (N .LT. 2) GO TO 495 **
      DO 420 I = 2, N
420 TA (I) = XX (I - 1) **
495 CONTINUE **
      IF (M .LT. 1) GO TO 500 **
      DO 430 I = 1, M
      IF ((I .EQ. M) .OR. (I .EQ. 1)) 425, 430
425 PRINT 1562, XP (I), TA (I)
1562 FORMAT (/F8.2,2F9.2,F14.9)
      GO TO 435
430 PRINT 1562, XP (I), TA (I), DX (I), EE (I)
435 CONTINUE **
500 CONTINUE **
      PRINT 1561
1561 FORMAT (//* PBAK IBAR*)
      MM = M - 1
      IF (MM .LT. 1) GO TO 505 **
      DO 440 I = 1, MM
      IBAR (I) = .5 * (TA (I) + TA (I + 1))
      PRINT 1562, PBAK (I), IBAR (I)
440 CONTINUE **
505 CONTINUE **
      CALL PLOT (XP, TA, NPIW, 2)
445 GO TO KPRT, (410, 450)
450 IF ((NITER .GT. 2) .AND. (V .LE. 1.E-9)) GO TO 460
      IF (KV (10) .EQ. 0) GO TO 460
455 CONTINUE
460 CALL CRIPLT (0, 0, 0, 0, 20)
      RETURN
      END

```

```

SUBROUTINE CALC (X, E, U)
COMMON /PTW/XP(200),X1(200),X2(200),TA(200)
COMMON /HEAD /ISTA, MDATE, NDATE, VL1, VWL2, IF1, IF2, FNU1, FNU2,
1 NPAGE, DNU, NPIW, IBRIIE
COMMON /PARAMT /M, NANGLES, NU1, NU2, NU3, MK, LUDD, NCOSW, P, Q,
1PI, LUN, NOZSW
COMMON /WATERP /RNOBS, FWZ, H2T, VLAMB
COMMON /PROF /RADC (15), RADO (15), NFRQL (15), NFRQU (15), NFRQ
COMMON /VALUE /AII
C
DIMENSION X (15), E (15)
C
N = M - 1
IF (N .LT. 2) GO TO 110 **
DO 100 I = 2, N
TA (I) = X (I - 1)
X1 (I) = TA (I) - 273.16
100 CONTINUE
110 CONTINUE **
U = 0.
DNU = NU3
IF (NFRQ .LT. 1) GO TO 115 **
DO 100 NF = 1, NFRQ
NU1 = NFRQL (NF)
NU2 = NFRQU (NF)
RNOBS = RADO (NF)
CALL CALWAT (X1, FWZ, 2)
RADVAL = FWZ
RADC (NF) = AII
E (NF) = RADVAL
U = U + RADVAL ** 2
105 CONTINUE
115 CONTINUE **
U = SQRT (U / NFRQ)
RETURN
END

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SUBROUTINE MINMYZ (Y, DX, NN, E, MM, W, KX, U, XTM)
DIMENSION X (15), DX (15), E (15), EE (15), KX (10), DE (15), DDE
1 (15), XTM (10, 15), ATN (15, 15), XTNA (15, 16), DEL (15), Y (15)
CLOSED (A, X, B) = AMIN1 (AMAX1 (AMIN1 (A, B), X), AMAX1 (A, B))
VN = 0
M = MM
N = NN
V = U
Z = W
IF (N .LT. 1) GO TO 450
DO 100 L = 1, N
100 X (L) = Y (L)
450 CONTINUE
ZU = 7
VU = V
NUM = 0
KX6 = KX (1)
KX (7) = 0
KX (8) = 0
KX (9) = 1
KX (10) = 0
PER = 0.1 * FLOAT (KX (3))
ZM = 0.001 * FLOAT (KX (5))
Z = 0.0001 * (ZM, Z, 1.)
FM = 0
DLM = KX (4)
IF (DLM) 110, 105, 110
105 DLM = 100.
110 IF (N .LT. 1) GO TO 455
DO 190 I = 1, N
IF (DV (I)) 115, 190, 115
115 NUM = NUM + 1
X (I) = X (I) + DX (I)
CALL CALC (X, EE, VN)
D = 0.
IF (M .LT. 1) GO TO 460
DO 120 L = 1, M
XTM (1, NUM) = (EE (L) - E (L)) / DX (I)
120 D = D + XTM (L, NUM) * * 2
460 CONTINUE
IF (D) 125, 125, 135
125 X (I) = X (I) - DX (I)
130 DX (I) = 0.
NUM = NUM - 1
GO TO 190
135 IF (V - VN) 140, 135, 135
140 IF (M .LT. 1) GO TO 465
DO 145 L = 1, M
145 E (L) = EE (L)
465 CONTINUE
KX (8) = 1
BET = 100. * (V - VN) / V
V = VN
IF (BET - PER) 150, 150, 150
150 KX (7) = 1
GO TO 190
155 DX (I) = - DX (I)

```



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IF (D, M) 160, 160, 105
160 X (I) = X (I) + DX (I)
GO TO 190
165 X (I) = X (I) + DX (I) * 2.
CALL CALC (X, EE, VN)
D = 0.
IF (M .LT. 1) GO TO 470
DO 17 L = 1, M
XTM (I, NUM) = (EE (L) - E (I)) / DX (I)
170 D = D + XTM (L, NUM) * * 2
470 CONTINUE
IF (D, 175, 175, 180
175 X (I) = X (I) - DX (I)
GO TO 130
180 IF (VN - V) 140, 185, 185
185 X (I) = X (I) - DX (I)
DX (I) = DX (I) * .5
190 CONTINUE
455 CONTINUE
IF (N, M) 195, 195, 210
195 KX (9) = - 1
GO TO 420
C ORIGINAL MINMY DECK INSERTED HERE.
200 IF (M .LT. 1) GO TO 475
DO 20 LL = 1, M
205 EE (LI) = XTM (LL, NUM + 1) * E (LL)
475 CONTINUE
GO TO 270
210 IF (M .LT. 1) GO TO 480
DO 22 LL = 1, M
215 EE (LI) = ABS (E (LL))
220 XTM (I, L, NUM + 1) = 1.
480 CONTINUE
CALL SORT (EE, M)
EMX = EE (M)
EMN = EE (M + 1 - NUM)
IF (EMN .EQ. 0) GO TO 225
IF (1.00. * EMN - EMX) 235, 225, 225
225 IF (M .LT. 1) GO TO 485
DO 23 LL = 1, M
230 EE (LI) = E (LL)
485 CONTINUE
GO TO 255
235 EX = 2.9077553 / ALOG (EMX / EMN) - 1.
IF (M .LT. 1) GO TO 490
DO 25 LL = 1, M
IF (ABS (E (LL)) - EMN) 250, 250, 240
240 FAC = (ABS (E (LL) / EMN)) * * EX
IF (N, M .LT. 1) GO TO 495
DO 24 KK = 1, NUM
245 XTM (I, L, KK) = FAC * XIM (LL, KK)
495 CONTINUE
XTM (I, L, NUM + 1) = FAC
250 EE (LI) = XTM (LL, NUM + 1) * E (LL)
490 CONTINUE
255 IF (N, M .LT. 1) GO TO 500
DO 26 II = 1, NUM

```



```

IF (NIM .LT. 1) GO TO 505 **
DO 26= J = 1, NUM
XIN (I, J) = 0.
IF (M .LT. 1) GO TO 510 **
DO 26= KK = 1, M
260 XIN (I, J) = XIN (II, J) + XIM (KK, II) * XIM (KK, J) **
310 CONTINUE
265 XIN (I, II) = XIN (II, J) **
505 CONTINUE **
500 CONTINUE **
270 IF (NIM .LT. 1) GO TO 515
DO 27= LL = 1, NUM
XINA (LL, NUM + 1) = 0.
IF (M .LT. 1) GO TO 520 **
DO 27= II = 1, M
275 XINA (LL, NUM + 1) = XINA (LL, NUM + 1) - XIM (II, LL) * EE (II) **
520 CONTINUE **
515 CONTINUE **
IF (NIM .LT. 1) GO TO 525
DO 28= II = 1, NUM
IF (NIM .LT. 1) GO TO 530 **
DO 28= J = 1, NUM
280 XINA (II, J) = XIN (II, J) **
530 CONTINUE **
525 CONTINUE
CALL GAUSSEL (XINA, 15, NUM, NUM + 1, LDL)
IF (LDL - NUM) 285, 290, 285
285 KX (9) = 0
PRINT 1500, NUM, LDL
1500 FORMAT (' SINGULAR MATRIX, ORDER#, I2, #, RANK# I2#, #) **
GO TO 420
290 NS = 7 **
295 IF (N .LT. 1) GO TO 535
DO 30= K = 1, N
DEL (K) = 0.
IF (DV (K)) 300, 305, 300
300 NS = NS + 1
DLMDX = ABS (DLM * DX (K))
DEL (K) = CLOSEST (- DLMDX, XINA (NS, NUM + 1), DLMDX)
XINA (NS, NUM + 1) = DEL (K)
305 CONTINUE **
535 CONTINUE **
ZZ = 7 **
310 IF (N .LT. 1) GO TO 540
DO 31= K = 1, N
315 X (K) = X (K) + ZZ * DEL (K) **
540 CONTINUE **
CALL CALC (X, EE, VN)
A = 0.
B = 0.
C = 0.
D = 0.
IF (M .LT. 1) GO TO 545 **
DO 32= I = 1, M
DE (I) = 0.
IF (NIM .LT. 1) GO TO 550 **
DO 32= K = 1, NUM

```

```

320 DE (I) = DE (I) + XIM (I, K) * XTNA (K, NUM + 1)
550 CONTINUE
DDE (I) = (EE (I) - E (I) - 7 * DE (I)) / 2 * * 2
A = A + DE (I) * DDE (I)
B = B + DE (I) * DE (I) + 2 * E (I) * DDE (I)
C = C + E (I) * DE (I)
325 D = D + DDE (I) * * 2
545 CONTINUE
A = 3.0 * A
D = D + D
ZP = - C / B
DO 330 I = 1, 10
DZ = (C + ZP * (B + ZP * (A + ZP * D))) / (B + ZP * (A + A * 3. *
1ZP * n))
ZP = 7P - DZ
IF (ABS (DZ) - 0.0001) 335, 375, 330
330 CONTINUE
335 ZP = CLOSER (ZM, ZP, 1.0)
SQE = 0.
IF (M .LT. 1) GO TO 555
DO 340 I = 1, M
340 SQE = SQE + (E (I) + ZP * (DE (I) + ZP * DDE (I))) * * 2
555 CONTINUE
VP = CQRT (SQE / FM)
345 BET = (V - VN) / V * 100.
350 IF (BET) 370, 370, 355
355 V = VN
KX (8) = 1
IF (M .LT. 1) GO TO 560
DO 360 I = 1, M
360 E (I) = EE (I)
560 CONTINUE
IF (BET - PER) 375, 365, 365
365 Z = ZP
KX (7) = 1
KX6 = KX6 - 1
IF (KX6) 410, 410, 200
370 KX6 = KX6 - KX (2)
IF (KX6) 430, 430, 440
375 KX6 = KX6 - KX (2)
IF (KX6) 410, 410, 380
380 IF (100. * (V - VP) / V - PER) 410, 385, 385
385 ZZ = 7P - Z
IF (ZZ) 390, 410, 405
390 ZZ = - ZZ
IF (N .LT. 1) GO TO 565
DO 390 K = 1, N
395 DEL (K) = - DEL (K)
565 CONTINUE
IF (NIM .LT. 1) GO TO 570
DO 400 K = 1, NUM
400 XTNA (K, NUM + 1) = - XTNA (K, NUM + 1)
570 CONTINUE
405 Z = Z7
GO TO 310
410 Z = Z0
KX (10) = 1000. * (V0 - V) / V0

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IF (Ky (10) - KA (6)) 420, 415, 415
415 Z = Zr
420 IF (N .LT. 1) GO TO 575
DO 421 L = 1, N
425 Y (L) = X (L)
575 CONTINUE
U = V
W = Z
RETURN
430 IF (N .LT. 1) GO TO 580
DO 431 I = 1, N
435 X (I) = X (I) - Z * DEL (I)
580 CONTINUE
GO TO 410
440 IF (1.0 * (V - VP) / V - PE) 430, 445, 445
445 ZZ =  $\gamma_P$  - Z
Z = Zr
GO TO 310
END

```



```

SUBROUTINE GAUSSL (C, NRD, NRR, NCC, NSF)
DIMENSION C (15, 16), L (16, 2)
BITS = 2. * * (- 18)
NR = NRR
NC = NCC
C INITIALIZE.
NSF = 0
NRM = NR - 1
NRP = NR + 1
D = 1.
LSD = 1
IF (ND .LT. 1) GO TO 225 **
DO 102 KR = 1, NR
L (KR, 1) = KR
100 L (KR, 2) = 0 **
225 CONTINUE
IF (ND - 1) 105, 155, 105
C ELIMINATION PHASE.
105 IF (NDM .LT. 1) GO TO 230 **
DO 152 KP = 1, NRM
KPP = KP + 1
PM = 0.
MPN = 0
C SEARCH COLUMN KP FROM DIAGONAL DOWN, FOR MAX PIVOT.
IF (ND .LT. KP) GO TO 235 **
DO 112 KR = KP, NR
LKR = L (KR, 1)
PT = ABS (C (LKR, KP))
IF (PT - PM) 115, 115, 110
110 PM = PT
MPN = KR
LMP = LKR
115 CONTINUE **
235 CONTINUE
C IF MAX PIVOT IS ZERO, MATRIX IS SINGULAR.
IF (MPN) 120, 215, 120
120 NSF = NSF + 1
IF (MPN - KP) 125, 130, 125
C NEW ROW NUMBER KP HAS MAX PIVOT.
125 LSD = - LSD
L (MPN, 1) = L (KP, 1)
L (KP, 2) = L (MPN, 1)
L (KP, 1) = LMP
C ROW OPERATIONS TO ZERO COLUMN KP BELOW DIAGONAL.
130 MKP = L (KP, 1)
P = C (MKP, KP)
D = D * P
IF (ND .LT. KPP) GO TO 240 **
DO 152 KR = KPP, NR
MKR = L (KR, 1)
Q = C (MKR, KP) / P
IF (Q) 135, 150, 135
C SUBTRACT Q * PIVOT ROW FROM ROW KR.
135 IF (ND .LT. KPP) GO TO 245 **
DO 142 LC = KPP, NC
R = Q * C (MKP, LC)
C (MKR, LC) = C (MKR, LC) - R

```



```

IF (ABS (C (MKR, LC)) - ABS (R) * BITS)140, 145, 145
140 C (MKR, LC) = 0.
145 CONTINUE
245 CONTINUE
150 CONTINUE
240 CONTINUE
230 CONTINUE
C LOWER RIGHT HAND CORNER.
155 LNR = L (NR, 1)
P = C (LNR, NR)
IF (P, 160, 215, 160)
160 NSF = NSF + 1
D = D * P * LSD
IF (ND - NC)165, 210, 165
C BACK SOLUTION PHASE.
165 IF (NR .LT. NRP) GO TO 250
DO 195 MC = NRP, NC
C (LNR, MC) = C (LNR, MC) / D
IF (ND - 1)170, 190, 170
170 IF (NDM .LT. 1) GO TO 255
DO 185 LL = 1, NRM
KR = NR - LL
MR = 1 (KR, 1)
KRP = KR + 1
IF (ND .LT. KRP) GO TO 260
DO 185 MS = KRP, NR
LMS = L (MS, 1)
R = C (MR, MS) * C (LMS, MC)
C (MR, MC) = C (MR, MC) - R
IF (ABS (C (MR, MC)) - ABS (R) * BITS)175, 180, 180
175 C (MR, MC) = 0.
180 CONTINUE
260 CONTINUE
185 C (MR, MC) = C (MR, MC) / C (MR, KR)
255 CONTINUE
190 CONTINUE
250 CONTINUE
C SHUFFLE SOLUTION ROWS BACK TO NATURAL ORDER.
IF (NDM .LT. 1) GO TO 265
DO 205 LL = 1, NRM
KR = NR - LL
MKR = L (KR, 2)
IF (MKR)195, 205, 195
195 MKP = L (KR, 1)
IF (NR .LT. NRP) GO TO 270
DO 205 LC = NRP, NC
Q = C (MKR, LC)
C (MKR, LC) = C (MKP, LC)
200 C (MKP, LC) = Q
270 CONTINUE
205 CONTINUE
265 CONTINUE
C NORMAL AND SINGULAR RETURNS. GOOD SOLUTION COULD HAVE D=0.
210 C (1, 1) = D
GO TO 220
215 C (1, 1) = 0.
220 RETURN

```

```

SUBROUTINE SORT(SS,N)
DIMENSION SS(20)
MO=N
2 IF (MO-1) 21,21,23
21 IF (MO-1) 9,9,22
22 MU=2*(MU/4)+1
GO TO 24
23 MU=2*(MU/4)+1
24 KO=N-MU
JO=1
25 I=JO
26 IP=I+1
IF (SS(I)-SS(IP)) 28,28,27
27 IT=SS(I)
SS(I)=SS(IP)
SS(IP)=IT
I=I-MU
IF (I-1) 28,26,26
28 JO=JO+1
IF (JO-KO) 25,25,2
9 RETURN
END

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SUBROUTINE PTPLUT (PP, I, N, MC)

```

DIMENSION ID (6), XS (2), YS (2), XB (2), YB (2)
DIMENSION NXH (6), NXI (6), QVT (6), NHT (6)
DIMENSION XN (200), YN (200)
DIMENSION PP (200), Y (200)
DIMENSION IVERT(3), IAHORIZ(3)

```

```

CALL CRIPLT (XS, YS, 0, ID, )
CALL CRIPLT (XB, YB, 0, 1, 1)
      HEADIGS
CALL CRIPLT (-15., 102.5, XT, IHEAD, 10)
CALL CRIPLT (-15., 50., NV, IVERT, 10)
CALL CRIPLT (50., -15., NHT, IHORZ, 10)

```

CONTINUE _____ Y TIC MARKS

```

AV = 750. / (XVMAX - XVMIN)
BV = - AV * XVMIN
CALL CRTPLT (0, 0, 3H0-- , 3, 5),
P = YMIN
GO TO (120, 135), NVPAIH
DP = P * .1
IF (NCYC .LT. 1) GO TO 235
DO 130 NC = 1, NCYC
DO 120 I = 1, 9
IF ((I .EQ. 9) .AND. (NC .EQ. NCYC)) GO TO 130
P = P - DP
PV = ALUG10 (P)

```



```

      YY = AV * PV + BV
      CALL CRIPLT (0, YY, 1, 1, 1)
      CALL CRIPLT (150., YY, 1, 1, 1)
125  CONTINUE
      P = DP
      DP = P * .1
130  CONTINUE
235  CONTINUE
      GO TO 145
135  DP = 100.
      DO 140 I = 1, 6
      P = P - DP
      YY = AV * P + BV
      CALL CRIPLT (0, YY, 1, 1, 1)
140  CALL CRIPLT (150., YY, 1, 1, 1)
      C
      X SCALE VALUES
145  DX = (XMAX - XMIN) * .2
      DO 150 I = 1, 6
      XV = XMIN + (I - 1) * DX
      XX = 70 * (I - 1) - 3
      ENCODE (5, 1500, III) XV
1500 FORMAT (F5.0)
      CALL CRIPLT (XX, - 5., NXH, III, 10)
150  CONTINUE
      C
      Y SCALE VALUES
      GO TO (155, 165), NVPAIH
155  DY = 150. / NCYC
      NCP = NCYC + 1
      P = YMIN * 10.
      IF (NCP .LT. 1) GO TO 240
      DO 160 I = 1, NCP
      P = P * .1
      YV = LOG10 (P)
      YV = AV * YV + BV
      ENCODE (4, 1502, III) P
1502 FORMAT (F6.1)
      CALL CRIPLT (- 12., YV, NXH, III, 10)
160  CONTINUE
240  CONTINUE
      RETURN
165  DY = 100.
      P = 100.
      DO 170 I = 1, 8
      YY = P - (I - 1) * DY
      YV = AV * YY + BV
      ENCODE (5, 1500, III) YY
170  CALL CRIPLT (- 10., YV, NXH, III, 10)
      RETURN
      C
      ENTRY TPLOT
      M = N + 1
      GO TO (175, 180), MC
175  CALL CRIPLT (0, 0, 3H+0X, 1, 5)
      GO TO 185
180  CALL CRIPLT (0, 0, 3H+00, 1, 5)
185  IF (M .LT. 1) GO TO 245
      DO 230 I = 1, M

```



```

IF (I.EQ. 1) 190, 195
190 PVAL = PP (1)
    TVAL = I (1)
    GO TO 210
195 IF (I.EQ. M) 200, 205
200 PVAL = PP (I - 1)
    TVAL = T (I - 1)
    GO TO 210
205 PVAL = PHAR (I - 1)
    TVAL = TBAR (I - 1)
210 XN (I) = AH * TVAL + BH
    GO TO (215, 220), NVPATH
215 YN (I) = AV * ALOGIU (PVAL) + BV
    GO TO 225
220 YN (I) = AV * PVAL + BV
225 CALL ARIPLT (XN (I), YN (I), 1, 1, 1)
230 CONTINUE
245 CONTINUE
    CALL ARIPLT (0, 0, 0, 0, 8)
    CALL ARIPLT (XN, YN, M, 1, 1)
    RETURN
END

```